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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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VOLUME 17 NUMBER 15 / AUGUST 8, 1979

TABLE OF CONTENTS

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1923

02 AERODYNAMICS 1925
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For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1930
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For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1930
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For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1931
Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1932
Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1933
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1935
Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1936
Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1937
For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1937
Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

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16 SPACE TRANSPORTATION 1938
Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

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17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1939
Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1939
Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1947

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24 COMPOSITE MATERIALS 1947

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1949

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27 NONMETALLIC MATERIALS 1959

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1962

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

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For related information see also *Physics.*

31 ENGINEERING (GENERAL) 1965

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32 COMMUNICATIONS 1967

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For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1974

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 1978

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 1983

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For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 1984

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1986

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1988

Includes product sampling procedures and techniques; and quality control.

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For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 1995
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 1998
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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION 2010
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2013
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 2020
Includes weather forecasting and modification.

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Includes biological, dynamic and physical oceanography; and marine resources.

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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2029
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE 2030
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2031
Includes computer networks.

63 CYBERNETICS 2032
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS 2032
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2035
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2037
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2037
Includes topology and number theory.

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For related information see also *Engineering.*

70 PHYSICS (GENERAL) 2038
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS 2042
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2044
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2048
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2049
Includes light phenomena.

75 PLASMA PHYSICS 2051
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2054
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

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Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2060
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 2063

89 ASTRONOMY 2063
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2064
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2064
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2065
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2066
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

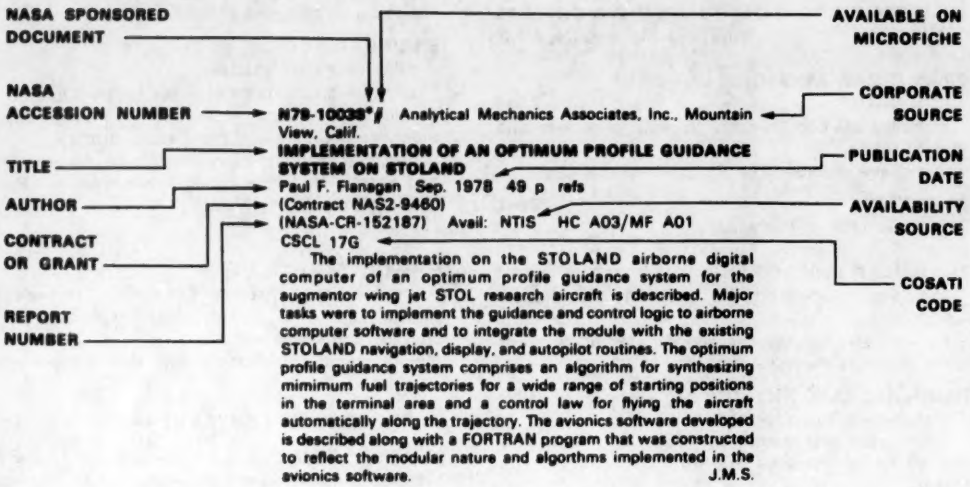
GENERAL

99 GENERAL 2066

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-53
CORPORATE SOURCE INDEX I-61
CONTRACT NUMBER INDEX I-75
REPORT/ACCESSION NUMBER INDEX I-79

TYPICAL CITATION AND ABSTRACT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N78-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
Paul F. Flanagan Sep. 1978 49 p refs
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AEROSERVOELASTICITY

M.A. Cutchins, Auburn University, School of Engineering, Dept. of Aerospace Engineering, *Auburn, Alabama* 36830 (DF641530; F08635-78-C-0027)

Air Force function - this work unit is established to develop an analytical capability to predict dynamic instabilities resulting from the influence of servo systems on aircraft flutter from a time domain base. Deficiency or opportunity - passive flutter studies alone will not define dynamic instabilities of aircraft. Objective - time domain based servo influences on the instability of an aircraft will be employed. How work contributes - this program will be used to define all future aircraft structural dynamic characteristics.

The techniques and procedures necessary to perform an aeroservoelastic analysis of a winged vehicle will be explored. Computer simulation of a flight control system using an all digital approach will be employed and coupled with the structural dynamic characteristics of USAF aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0002, IMPROVED SURGE MARGIN CENTRIFUGAL COMPRESSOR

R. Clarke, Signal Companies Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0D3999; DAAJ02-75-C-0033)

The objective is to investigate experimentally the factors critical to centrifugal compressor flow range, surge, and efficiency flow characteristics, and subsequently, to demonstrate a single-stage, high-pressure-ratio centrifugal compressor having peak performance on or near a projected engine operating line. Achievement will result in approximately a four point improvement over current operating line efficiency with a predicted 6-8 percent reduction in fuel consumption and its attendant potential for increased range and/or payload for future Army helicopters.

Design a baseline 10-1 pressure ratio compressor having a geometry favorable to broad flow range and a number of modifications thereof varying geometrical/aero factors critical to flow range and efficiency. Fabricate, test and analyze data to formulate design correlations for the critical factors. Use the correlations to design, fabricate and test an optimum compressor stage.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION - ARMY HELICOPTER

R.W. Vershure, Signal Companies Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0D4114; DAAJ02-77-C-0032)

To provide and demonstrate the technology required to economically manufacture a cooled, high-temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future Army requirements for reliable, low-cost, high-performance, small gas turbine engines.

The program will be conducted in three phases - Phase I, detailed design and manufacturing activity development; Phase II, prototype wheel fabrication; Phase III, mechanical integrity verification. The process will consist of photoetching thin sheets of laminates of astroloy. This is followed by stacking and bonding the sheets. The resulting component is then finished - machined to the desired external contours.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, ADAPTIVE ESTIMATION OF INFORMATION VALUES IN CONTINUOUS DECISION MAKING AND CONTROL OF ADVANCED AIRCRAFT

A. Freedy, Perceptronics Inc., *6271 Variel Ave., Woodland Hills, California* 91364 (DF043820; F44620-76-C-0094)

AF function - the research is a continuation program of research and development directed toward evaluation of information needs in decision making and control of advanced aircraft. Deficiency - a quantitative and general technique for evaluating decision information needs in continuous control of advanced aircraft will fill the need for a general realizable instrument capable of analyzing, evaluating, and allocating available information for decision making in a variety of complex systems. Objective - the research will broaden the concept of real-time management of communications from RPV supervision to more general command and control contexts. It incorporates the current work on multi-attribute utility modeling, resulting in a continuous three-year effort. How research contributes - the program will result in aids for the real-time management of man-machine communications.

The research will extend the capabilities and, in turn, the range of application of the information value models, and will result in guidelines for application of the methodology in operational systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0005, ACTIVE FLUTTER SUPPRESSION ON AEROELASTICALLY TAILORED HIMAT VEHICLE

J.H. Wykes, Rockwell International Corp., *International Airport, Los Angeles, California* (DF141060; F33615-78-C-3200)

The HIMAT vehicle has aeroelastically tailored wings for improved maneuverability. The aeroelastic twist control design approach resulted in low flutter speeds and rather than revise the structural design, mass balance weights were added to the wings and canards. The objective of this effort is to define the feasibility and potential benefits of an active flutter suppression system on aeroelastically tailored composite wings. An active flutter suppression system may provide a more efficient, weight-saving approach.

Using the available himat data, an analytical model will be developed and an active flutter suppression system will be synthesized. Trade-off studies will include system gain and com-

pensation, sensor locations, size of control surfaces, maximum deflection and rate, and gust level to evaluate feasibility of the active flutter suppression system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, FLIGHT DYNAMICS SYSTEM RESEARCH

C.T. Leondes, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering Systems, *405 Hilgard Ave., Los Angeles, California* 90024 (DF139540; F33615-77-C-3013)

This program is for research and development in advanced control theory and technology for application to advanced military vehicles and control system problems. Control configured vehicles will provide new dimensions in aircraft guidance and control. New flight control systems must be designed to efficiently integrate and effectively utilize the advanced capabilities of these aircraft. Basic research will be conducted to formulate a functional flight control design using optimal control and other advanced design techniques. The design will be intended for use on advanced aircraft with new control capabilities.

Several tasks or study efforts will be investigated which are essential to preliminary designs of an AFTI-type vehicle. These include application of optimal control theory for precise terminal control problems as applied to air combat or air-to-ground role. New mathematical approaches will be utilized which may tend to produce new methods to solve existing flight dynamics problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, WIND TUNNEL INVESTIGATION OF THE AIRFLOW OF A MODEL HELICOPTER FOR DETERMINATION OF AERODYNAMIC INTERFERENCE (ABBREV)

A.J. Landgrebe, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DA0F9013; DAAG29 77 C 0013)

To experimentally investigate helicopter rotor wakes for low forward speeds characteristic of current rocket firing tactics accounting for interference effects of the fuselage, wing, and the ground, and to utilize this data for determining analytically the velocity distributions along trajectories through the wake. Relevance -the research is directly relevant to the problem of a sight correction system on the AH-1G for the 2.75 in. rocket and to the problem of determining the correct position for a wind sensor. In addition, it is relevant to the determination of helicopter aerodynamic characteristics required in other investigations such as those associated with low-speed, terrain flying missions.

Rotor wakes produced by a combined model rotor-fuselage-wing will be examined and measured by means of both laser velocimeter and visualization techniques for determining the wake velocities and geometries, respectively. The results of the experimental program will provide velocity and wake geometry data for correlation with theory and for a systematic determination of the effects of aircraft components, ground effect, and significant flight parameters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0008, HELICOPTER DRIVE SYSTEM R&M DESIGN GUIDE

K. Keller, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0D4084; DAAJ02-76-C-0047)

Establish detail R&M design and test criteria for helicopter drive systems. Criteria are to be developed in both quantitative and qualitative forms.

A guide will be developed to qualitatively and quantitatively relate pertinent design, development, and manufacturing issues to the ultimate achieved reliability and maintainability characteristics of helicopter drive system components. The guide will incorporate results of previous drive system work as well as criteria developed under this work.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0009, MILITARIZED HELICOPTER TRANSPORTED CONTAINER HANDLING DEVICE

S.P. Jarosinski, Martin Marietta Corp., Baltimore Division, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DA0E3844; DAAK51 78 C 0026)

The objective of this contract is for ATL to procure an operational prototype helicopter transported container lift adapter to be used for flight evaluation and operational suitability testing.

Martin Marietta Corp shall furnish all resources necessary to procure and fabricate the required materials and components for the assembly and limited acceptance testing of two container lift adapters. Fabrication and assembly shall be in accordance with government furnished drawings and instructions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, ASSESSMENT OF AUGMENTED ELECTRONIC FUEL CONTROLS FOR MODULAR ENGINE DIAGNOSTICS AND CONDITIONING MONITORING

H.D. Hoffman, General Electric Co., Aircraft Engine Group, *1000 Western Ave., Lynn, Massachusetts* 01910 (DA0E3791; DAAJ02-77-C-0065)

To establish the requirements for, define the approach to be used, and assess the impact of including diagnostic and condition monitoring (D&CM) requirement features in the design of future advanced control systems for turboshaft helicopter engines.

The contractor shall identify the D&CM objective which could be accomplished by their inclusion in the design of a FADEC system. The parameters to be sensed shall be identified and the impact of integrating the D&CM objectives on the full authority digital electronic control (FADEC) system design shall be addressed. The feasibility of developing sensors and logic required for the FADEC/D&CM integrated system shall be identified.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0011, AFFDL/MBB FLUTTER SUPPRESSION FLIGHT TEST PROGRAM

O. Sensburg, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF142190; F33615-78-C-3219)

Fighter attack aircraft historically are hampered with sometimes severe flight envelope restrictions due to external store flutter. Active flutter suppression has been shown through analyses to have sufficient capability to prevent wing/store flutter thereby removing flutter speed placards and improving performance through flight envelope expansion. The objective of this program is to conduct flight tests on an F-4 aircraft, and substantiate the feasibility of active flutter suppression for preventing flutter. The results of this program will ultimately provide USAF fighter aircraft with an air-to-ground mission, an expanded attack envelope, increased survivability and improved operational flexibility.

An active flutter suppression system will be designed and implemented into an F-4 aircraft owned by the Federal Republic of Germany. The aircraft will be flight tested in West Germany under a cooperative AFFDL/Federal Republic of Germany (Ministry of Defense)/Messerschmitt-Bolkow-Blohm program for evaluating the system operational capability. The AFFDL will also conduct analyses for determining the effects of nonlinearities within the aircraft control and actuation systems prior to first flight.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, EVALUATION OF A GOVERNMENT-OWNED AUTOMATIC LANDING DIRECTION INDICATOR (ALDI)
Unknown, Marion City Government, *Marion, Ohio* 43302 (FA78NA-AP-3; FA161200 (TRAIS NO.))

The purpose of this Agreement is to permit the FAA to conduct an evaluation of a Government-owned Automatic Landing Direction Indicator (ALDI). The site for this evaluation effort is the Marion Municipal Airport, Marion, Ohio. The evaluation efforts will entail the use of General Aviation Aircraft under normal daily operations at the Marion Municipal Airport. Questionnaires and/or individual subjective opinions will be asked of tenants and pilots using the Marion Municipal Airport; and the ALDI system will be evaluated. This test phase is a form of in-service testing to determine if the ALDI is an aid to the pilots and/or the airport operation.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0013, EVALUATION OF ADVANCED CRYOGENIC COOLER DESIGNS AND COMPONENTS
J.W. Ackerson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141580)

Long- and short-term problems for satellite aircraft and missile cryogenically cooled surveillance systems have been identified. Past developmental programs have shown a lack of understanding in cold finger dynamics, linear magnetic drive compressors, flexible lines, quick disconnects and cooler redundancies. The objective of this effort is to test and evaluate advance hardware and concepts relative to the problems. The technology and data base derived from this effort could be transitioned into production programs in the AIM-9l and standard cooler projects and in the HALO technology program.

The work unit will be divided into four areas of testing. Test and evaluate performance of split system remote cold finger expanders. Test and evaluate a linear magnetic drive compressor concept for use with split system remote cold finger expanders. Life test various flex line concepts and materials for gimbal interfacing problems. Life test commercially available quick disconnects for gimbal interfacing problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, LIFE ANALYSIS AND DESIGN METHODS FOR AEROSPACE STRUCTURES
F.D. Adams, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140470)

MIL-STD-1530A defines the overall requirements necessary to achieve structural integrity of USAF aircraft. MIL-A-83444 specifies applicable damage tolerance (safety) requirements and MIL-A-8866B identifies durability (economic life) requirements. The objective of this effort is to develop and verify analytical and experimental life analysis methods which can be used to satisfy the above requirements. These methods are needed to insure structural integrity of USAF aircraft and will result in increased safety and reduced life-cycle costs.

Employing engineering disciplines involving fatigue, fracture mechanics and reliability, methods of predicting the structural life will be developed and applied. Basic damage mechanisms will be investigated and appropriate analysis procedures developed. Specific tasks include: (1) analysis of load spectra to determine damaging components, (2) development of test and analysis spectra, (3) investigation of cycle counting procedures to determine how they influence damage prediction, (4) updating the cracks computer code as new or improved methods of predicting crack growth are developed, (5) studying load spectrum variations and sustained loading as to its influence on crack initiation, (6) investigation of the 'equivalent initial quality' method, (7) development of appropriate reliability procedures for application to structural integrity problems. In addition, existing and new life analysis procedures will be applied to aircraft design and fleet operations problems. Specific tasks include: (1) evaluation of the performance of currently available fatigue improvement fasteners, (2) determining the impact of the new damage tolerance spec, MIL-A-83444 on design, (3) preparation of a damage tolerance handbook, (4) investigating and devising tracking methods for fleet management.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, STABILITY AND CONTROL PREDICTION METHODS
D.E. Hoak, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF133300)

This work unit supports TPO 3, Flight Control, and specific goal FG02B, Flight Control System Design Techniques. The problem involved in accurately defining aerodynamic stability and control characteristics is critical to the successful accomplishment of both strategic and tactical combat missions. This objective is to continually examine new data and theoretical knowledge concerning the understanding and prediction of aerodynamic phenomena, with particular attention given to those aspects partinent to stability and control. Also, an awareness of existing and potential problems in this area must be fostered to insure appropriate application of existing knowledge and to form a basis for the formulation of programs to overcome critical deficiencies. Overcoming these deficiencies will significantly enhance the design of military aircraft by assuring that methods are available for determining satisfactory stability and control characteristics and for evaluating the effects of engineering fixes.

Studies of existing and new aerodynamic theory and experimental data compilations will be implemented to establish a comprehensive technology base. Attention will be focused on vital areas in which problems exist or are forseen and in which technology is deficient. Programs will be planned, and analytical, empirical and graphical relations will be developed to improve the prediction of aerodynamic stability and control characteristics for all classes of flight vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, MULTIPLE FRAGMENT IMPACTS ON SINGLE ENGINE AIRCRAFT FUEL SYSTEMS
P.M. Murawski, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138480)

The objective of this program is to evaluate the effects of multiple fragment impacts on single-engine type aircraft fuel systems. These effects include hydraulic RAM/structural damage, fuel ingestion, fire, and explosion. This program is designed to evaluate the range of test/target conditions which allow the results to be applied to a wide variety of warhead types (i.e., varying frag densities, mass, velocity, etc.) and aircraft configurations (i.e., thin skin, thick skin, full tanks, ullage, etc.). The data generated will be applicable to any single-wall type aircraft fuel tank where fragments would impact the tankage directly (as opposed to passing through a dry bay, void space, or inlet duct first).

This program will be a multi-phased, multi-year test and evaluation with specific milestones to be met for each phase. Various parameters will be tested; they include frag velocities of 3.0, 4.5, 6.5, 8.0 thousand ft/sec, densities of 2, 5, 10, 18 frags per ft, and frag weights of 10, 30, 60, 120, and 240 grains. Various launching techniques will also be tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, V/STOL FLYING QUALITIES CRITERIA DEVELOPMENT
K. Rowe, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141900)

This work supports the flying qualities specification MIL-F-8785B, and the flying qualities of piloted V/STOL aircraft specification, MIL-F-83300. In the past seven years since the release of the current specification, MIL-F-83300, there has been considerable work done in the area of piloted V/STOL aircraft. This new data should be used to update and validate this specification. In addition, the overall schedule for the change in format for all specifications to MIL-STD's indicates that MIL-F-83300 is to be combined with MIL-F-8785B by 1981. The objective of this work is to: 1) review and revise the flying qualities criteria for piloted V/STOL aircraft as presented in MIL-F-83300 and 2) combine

MIL-F-83300 and MIL-F-8785b into a single flying qualities standard or justify the need for an additional standard for V/STOL aircraft. Accomplishing this objective will help assure the flying qualities, and therefore the safety, of piloted V/STOL aircraft.

The approach to achieve this objective includes reviewing available V/STOL flying qualities data and comparing it with the requirements of MIL-F-83300. Flying qualities data from contracted efforts. The AMST development, etc., will be used to validate or revise these requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, MOLDABLE COMPOSITE SEAT

R. Freeman, Budd Co., *300 Commerce Dr., Fort Washington, Pennsylvania* 19034 (DN881495; N62269-78-C-0178)

Determine feasibility utilizing new available moldable composite structures for basic ejection seat design and manufacturing. Upon proven feasibility procure prototypes for verification test and evaluation. Develop specification and procure seats with components integrated with molded structure. This contract supports work unit ZA601 Agency Accession No 681080.

Investigate in a trade of study factors of cost, strength, weight, reliability, maintainability and manufacturing complexity in comparison with existing seat designs. Procure prototype seat(s) for test. Procure seats with all features incorporated.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0019, RADAR TECHNIQUES FOR AIR FORCE APPLICATIONS IN AVOIDANCE OF BIRD-AIRCRAFT COLLISIONS AND IMPROVEMENT OF FLIGHT SAFETY

S.A. Gauthreaux, Clemson University, School of Physics Mathematics & Biological Sciences, Dept. of Zoology, *Long Hall, Clemson, South Carolina* 29631 (DF031120; AFOSR-75-2782)

AF function - bird strikes continue to pose a major hazard to aviation, especially to high-speed, low-altitude missions. Optical techniques offer the most promising approach to reduce the number of collisions. An electrooptical system in detecting aloft bird concentrations is needed. Influence of landing lights will be evaluated via airport surveillance radar and direct visual techniques. Testing of an image intensifier will continue. Deficiency - the development of direct visual and radar techniques for detecting and monitoring hazardous concentrations of birds aloft is needed. Objective - this research has three objectives - 1) to accurately describe and quantify the various types of bird echoes that may appear on the radar screen during day and at night and identify the types of birds responsible, 2) to further evaluate the use of image intensifiers to monitor and quantify the migration of birds at night, and 3) to further examine the feasibility of using an image intensifying device (direct viewing or closed circuit television camera) to detect hazardous concentrations of birds from the ground and from the cockpit of an aircraft. How research contributes - this research relates to the use of radar and new direct visual means to reduce bird hazards to aircraft. Recent modifications of air traffic control radars (airport surveillance radars and air route surveillance radars) make the description and quantification of various types of bird displays on these radars feasible. The use of image intensifiers to directly observe migrating birds at night shows great promise for identifying the types of birds at night responsible for the echoes on radar. Image intensifiers may also be quite effective as onboard devices for detecting concentrations of birds aloft at night.

A three-pronged research program is proposed - 1) the description, quantification, and cataloging of bird echoes displayed on air traffic control radars, 2) the use of image intensification systems to monitor and quantify nocturnal bird migration, 3) the use of low light level closed circuit TV to detect migrating birds at night.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0020, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION

H. Hanson, Bell Helicopter Co., Division of Textron Inc, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3776; DAAJ02-77-C-0045)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion, airframe or drive systems. The problems of vibration related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0021, VECTORED ENGINE OVER WING CONCEPT EVALUATION STUDY

P.D. Whitten, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF139880; F33615-77-C-3097)

Maneuver performance improvements continue to be the major emphasis of advanced air combat aircraft studies. Aerodynamic/propulsion synergism, or propulsion-lift, has been previously shown to provide a design alternative which can result in significant payoffs. The vectored engine-over-wing (VEO-wing) concept offers a propulsion-lift approach which has been verified, through wind tunnel studies, for near-term fighter application. The objective of this effort is to conduct a study to determine the most cost-effective means for VEO-wing concept demonstration and to further evaluate the performance potential resulting from concept application. Results from this study will provide data for evaluation of the concept for transition to advanced development.

Studies will be conducted to evaluate the vectored engine-over-wing concept potential for application to advanced air combat aircraft and to investigate technology demonstration approaches. Innovative methods, to cost-effectively demonstrate the VEO-wing concept, will be evaluated. Emphasis will be placed upon modification of existing vehicles. Performance evaluations will be conducted for air-to-air and air-to-ground VEO-wing configurations. The concept benefits will be identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, HT PP 78-08 - HIP DISK COOLING PROGRAM

J. Lane, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3811)

The objective of this effort is to evaluate the heat transfer characteristics of various quench media analytically to permit assessment of expected material property variations and provide for capability to analytically heat treat a turbine disk.

The effort utilizes measured heat transfer data obtained through existing contract from MM&T and models the data with a conduction heat transfer program to obtain effective heat transfer coefficients. These heat transfer coefficients are used to analytically heat a turbine disk and obtain expected property levels and property variation within the disk.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0023, HT PP 78-12 - INVESTIGATION OF DRIVE SHAFT SYSTEM DESIGN REQUIREMENTS
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3824)

To investigate drive shaft system problems encountered during recent helicopter development programs and on production aircraft, to define critical design parameters and limitations of current design tools.

Conduct discussions with major airframe manufacturers and drive shaft coupling manufacturers, to review past DOD reports and professional association papers pertaining to drive shaft system problems, and review military specs pertaining to helicopter drive shafting. Summarize results in a report.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0024, NONLINEAR ANALYSIS OF SQUEEZE FILM DAMPERS APPLIED TO GAS TURBINE HELICOPTER ENGINES 14100-E
E.J. Gunter, University of Virginia, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (DA0F8937; DAAG29 77 C 0009)

To study nonlinear effects of dynamic loading arising from engine acceleration, sudden unbalance, and rotor misalignment on damper performance. Relevance - this research is very important to the rotor dynamics program at the Eustis Directorate in that it will provide a valuable tool in the analysis of whirl in bearings of major importance in bearing systems for high-speed gas turbine engines.

Theoretical and experimental analyses, the former being based on the Reynolds equation from which regimes of stable journal operation will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0025, AEROELASTIC STABILITY AND PERFORMANCE CHARACTERISTICS OF AIRCRAFT WITH ADVANCED COMPOSITE SWEPT-FORWARD WING STRUCTURES
T.A. Weisshaar, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace & Ocean Engineering, *Blacksburg, Virginia* 24061 (DF141460; AFOSR-77-3423)

Preliminary studies indicate that aircraft with forward-swept wings show improvements in transonic performance when compared to conventional aircraft. Sweeping conventional metal wings forward decreases aeroelastic divergence speed but by using aeroelastic tailoring with advanced composites the forward-swept wing can be designed to be divergence-free. The Defense Advanced Research Projects Agency is sponsoring a program with AFFDL as its agent to study aircraft with forward-swept wings. As part of this program, the Virginia Polytechnic Institute (VPI) will study forward-swept wings constructed with advanced composites to determine the aeroelastic benefits of these wings. The work began 1 Sep 77 and will be monitored as part of this work unit.

The VPI program is a six-month study concerning the effect of three aeroelastic problems in the use of advanced composites on forward-swept wings - aspect ratio, static stability and trim, and maneuvering loads. Particular attention will be given to the assessment of the different types of composite materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, DEVELOPMENT OF NEW LOW-COST/LONG-LIFE MILITARY AIRCRAFT AIRFRAME BEARINGS CONCEPTS
W.F. Lynn, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF136130; F33615-76-C-3098)

This effort supports the development of airframe bearings for the Air Force aircraft. Existing airframe bearings are heavy, expensive, not compatible for use in composite material structures and current teflon type bearings experience very early failure when exposed to a liquid contaminated environment. The objective of this effort is to develop advanced plain bearings which resolve these problems, and to establish the feasibility of applying the concepts developed to spherical airframe bearings. It is expected that this effort will result in new design concepts and criteria for Air Force aircraft plain bearings which will weigh up to 75 percent less, decrease initial cost by up to 50 percent, are compatible for use in metallic or composite structures, and have long life when operating in a liquid contaminated environment.

Advanced materials, including composite materials, and new fabrication techniques will be evaluated for the fabrication of aircraft plain bearings. Design concepts will be originated for promising materials and fabrication techniques. Laboratory specimen and cyclic testing of developmental plain bearings shall be done under dry and liquid contaminated conditions. Test results shall be evaluated and compared to current plain aircraft bearings. A preliminary study shall be made applying the most promising concepts generated to the design of spherical bearings. Design concepts and criteria and test data will be presented in a technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, LEADING EDGE DESIGN STUDY FOR SWEPT-BACK SLENDER WINGS WITH OR WITHOUT SEPARATION
R.K. Nangia, University of Bristol, *Bristol, England, United Kingdom* (DF140640; AFOSR-77-3243)

In the design of high-performance fighter aircraft having large wing sweep, compromises occur in meeting the constraints of efficient high-speed cruise and good transonic maneuverability. Careful design of the leading edge geometry can lead to significantly improved wing performance (lift-drag ratio) in both speed regimes. Applying droop in the leading edge region by means of flaps, variable camber devices, or slats can lead to improvements although in general optimum geometric shapes must be found by trial and error. Leading edge design is further complicated for this class of wings by the possibility of flow separation and subsequent vortex formation. The object of the study is to provide guidelines to be used in designing leading edges of high-sweep wings in order to achieve the maximum aerodynamic efficiency.

A theoretical method will be developed to calculate the flow field for non-planar, highly swept wings of finite thickness having either separated or attached flow at the leading edge. The problem will be simplified by making the assumption of conical flow thereby allowing the problem to be reduced to a 2-D solution in the cross-flow plane in which conformal transformation techniques can be introduced. Leading edge separation will be analyzed with a Brown and Michael-type model for the free, rolled-up vortex sheet. This relatively simple approach will provide the means to investigate the details of the flow near the leading edge for a large number of cases at minimum computational cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, POLYMERS BASED ON OLIGOMERIC POLYBENZIMIDAZOLES WITH CARBOXYL END GROUPS 15485-C
C.S. Marvel, University of Arizona, School of Liberal Arts, Dept. of Chemistry, *Tucson, Arizona* 85721 (DA0F9188; DAAG29-78-G-0071)

To synthesize new polyamides and polyesters based on oligomeric polybenzimidazoles with carboxyl end groups as one of the 'monomers'. Relevance - the research is directly relevant to

a long-standing interest in thermally resistant polymers, especially hardened materials (AMMRC), improved fibrous material for protection against thermal effects (NARADCOM), and a wide range of other polymer uses (MERADCOM).

Oligomeric imidazoles (continuing 3-8 units) terminated by cyano-groups will be converted to dicarboxylic acids. These will be condensed with suitable diamines or diols to form the final polyamide or polyester.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0002, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH-STRENGTH, HIGH-STIFFNESS PARTICULATE COMPOSITE MATERIALS

O.D. Sherby, Stanford University, School of Engineering, Dept. of Materials Science, *Stanford, California* 94305 (DN723740; N00014-75-C-0662)

This research is aimed at composite materials with improved strength and stiffness for use in jet engines and airframes. Under investigation are the effects of processing variables on the structure and mechanical properties of particular composites.

Particulate composites of steel powders will be prepared and tested. Variables will include volume percent of the high carbon steel and low carbon steel powders, carbon content and size of the particles, and heat treatment parameters. Composites of a magnesium alloy containing boron in varying amounts will be prepared and tensile properties measured over the temperature range of 25 to 400 degrees centigrade.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0003, PHASE TRANSFORMATION RELATIONSHIP TO FATIGUE RESISTANCE IN TITANIUM

C.M. Gilmore, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Env Engin, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DN890089; N00019-78-C-0269)

Determine phase transformation mechanisms which enhance fatigue resistance of titanium.

Determine relationship between retained beta, and martensitic phase in Ti-6Al-4V to fatigue resistance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0004, MODIFICATION OF SURFACE PROPERTIES

J.K. Hirvonen, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780183)

To improve the corrosion resistance and load carrying ability of aircraft bearing and gear steels by ion implantation while maintaining compatibility with MIL-L-23699B lubricants.

Implant selected ions into m50 alloy test samples; then perform corrosion tests, fatigue lifetime tests, and electrochemical tests on implanted species to ascertain optimum implantation parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0005, MATERIAL SUPPORT TECHNOLOGY - POLYMER CHARACTERIZATION

W.B. Moniz, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880007)

The objective of the research is to devise and to perfect new instrumental techniques for the characterization of polymeric materials. The goal is improved quality control, reliability, and durability test criteria for Navy materials, such as structural polymers and adhesives, elastomers, and propellent binders.

New techniques for polymer characterization are to be developed, with emphasis on magnetic resonance and other instrumental methods. The techniques are evaluated and optimized with respect to their utility in analyzing polymer composition or behavior.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, CHEMICAL CHANGES IN HIGH-TEMPERATURE-STRESSED LUBRICANTS

H. Ravner, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680375)

To improve the capability and maintainability of present and future Navy aircraft by developing more stable lubricant formulations. This will require a better understanding of the chemical processes involved in the degradation of heat and oxygen-stressed lubricant base stocks and additives.

Model ester formulations will be exposed to very high-temperature environments (225 deg. to 350 deg. C). Reaction products of the base stocks and additives will be isolated and identified using appropriate instrumental and chemical procedures. From these data the mechanism of base stock and additive inhibition will be postulated, providing the basis for developing more efficient base stock-additive lubricant formulations for Navy aircraft use. NAPC will provide the engineering back-up required in this work.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0007, EFFECTS OF STRESS ON POLARIZED FERROELECTRIC CERAMICS

R.W. Timme, U.S. Dept. of Defense, Navy, Naval Research Lab., Underwater Sound Reference Div., *P.O. Box 8337, Orlando, Florida* 32856 (DN680267)

Characterize the effects of multidimensional sustained stresses on polarized ferroelectric ceramics. The potential relevance of this work is that a better understanding of how stresses individually and collectively act to affect the polarization, and therefore the piezoelectric and dielectric characteristics, of the ceramic may lead to the more nearly optimum design and use of acoustic transducers.

Characterization of the polarized ferroelectric ceramics will be accomplished by measuring the elements of the piezoelectric constant tensors d and g and the dielectric constant tensor epsilon as a function of stress magnitude, dimensionality, and orientation.

SUPPORTED BY U.S. Dept. of Defense, Office of Naval Research, Material Sciences Div.

3.0008, INVESTIGATION OF MECHANISMS AFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOYS

I.J. Graham, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mech Engin, *Baton Rouge, Louisiana* 70813 (DN890058; N00019-78-C-0065)

Program to investigate mechanism affecting environmental stress cracking in titanium alloys.

Use the fracture mechanics approach with the application of acoustic emission test techniques to predict the useful life of a structure subjected to sustained and/or cyclic loads under certain controlled environments at designed temperatures and pressures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, CERAMIC METAL WORKING DIES

G. Harris, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4819)

It is the technical objective of this project to advance the state of the art in the fabrication of ceramic tooling for hot metal-forming, particularly as practiced in the airframe industry. Properties to be investigated will include density, surface finish, hardness, thermal shock resistance, thermal conductivity, ease of casting, air setting and reproducibility.

Laboratory-sized ceramic dies will be fabricated with either embedded heating coils or silicon carbide heating elements. Properties such as hardness, ease of fabrication, density, surface finish and reproducibility will be noted before thermal testing. Tests will be conducted not only on single component ceramic materials, but on composites of two or more phases incorporating lower density ceramics in the mix to reduce the overall weight. The material will be tested at temperatures in the range of 1,450 degrees F, the present temperature requirement for manufacture of titanium spars at one of the helicopter companies.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0010, EVALUATION OF MATERIALS FOR FREE DROP CONTAINER

R. Vernet, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick*, *Massachusetts* 01760 (DA0H4281)

Provide an end item to replace the standard container (NSN 1670-00832-5917) which is no longer available for procurement and which was developed in accordance with the DA small development requirement (SDR) for free drop container for liquids. The SDR required the free drop of food and water to personnel operating in remote areas from aircraft flying at maximum 130 kias, maximum 76m above the ground.

Evaluate plastic film materials as possible replacement for the modified polyurethane material presently prohibited from use in the standard item. The item/items selected will then be airdrop tested for conformance to requirements.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

3.0011, FATIGUE CRACK PROPAGATION IN TITANIUM ALLOYS

D.A. Koss, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engin, *Houghton, Michigan* 49931 (DF037650; AFOSR-74-2596)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Opportunity - it is important to understand the mechanisms of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will examine the criterion for Stage I fatigue crack propagation (that which occurs initially along crystallographic slip planes) and determine the effect of materials parameters on these criterion in beta and alpha-beta titanium alloys. How work contributes -by better understanding of the influence of metallurgical parameters on fatigue crack propagation, guidelines for better fatigue resistance of structural alloys may be established.

In addition to obtaining the relationship between crack propagation rates, applied stress, and crack length, this study will explore the effects of environment, grain size, texture, slip character, and stress-strain behavior on Stage I crack growth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, NAVY ENVIRONMENT - FRETTING FATIGUE DAMAGE OF STRUCTURAL MATERIALS

D.W. Hoeppner, University of Missouri, Columbia Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *103 Engineering, Columbia, Missouri* 65201 (DN123528; N00014-75-C-0670)

The objective of this research is to determine the causes and failure mechanisms associated with fretting corrosion and fretting fatigue damage of structural alloys.

The investigator is undertaking a study of the manner in which fretting damage influences fatigue life on the fretted materials. The materials to be studied are steels, titanium and aluminum alloys. Variables to be assessed are: fatigue load, normal load, surface finish and surface material. Surface damage is to be a ascertained by scanning electron microscopy and conventional metallurgical techniques. The establishment of the physical processes that lead to the initiation of fretting-fatigue damage is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, SPUTTERED MERCURY-CADMIUM-TELLURIDE MATERIAL FOR INFRARED DETECTORS

R.H. Cornely, New Jersey Inst. of Technology, School of Engineering, Dept. of Electrical Engin, *323 High St., Newark, New Jersey* 07102 (DF047800; AFOSR-77-3249)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - materials sensitive in the far infrared region of the electromagnetic spectrum have a high impact for airborne and satellite applications. Objective - the aim of this research is to deposit and examine single crystals of HgCdTe by radio-frequency, triode-sputtering techniques, and to establish the dependence of material parameters such as band gap, carrier concentration and mobility, chemical composition and film stoichiometry upon deposition parameters such as Hg sputtering gas pressure, film deposition rate, and substrate material, temperature, r.f. bias and presputtering surface treatment. How work contributes - sophisticated electrooptical techniques in narrow band gap compound semiconductors offer promise for electrooptical microcircuitry and for wide-angled infrared sensing in the 3-5, 8-14, and 18-25 micro spectral regions.

The deposition of single crystal, stoichiometric films of (Hg,Cd)Te material involves radio-frequency (r.f.) triode-sputtering in a reactive mercury vapor atmosphere. Obtain a detailed understanding of the conductive, optical and compositional properties of sputtered HgCdTe films by measuring Hall effect and optical transmissivity and by Utilizing Auger spectroscopy, electron and x-ray diffraction methods, and chemical analysis techniques. Explore the methods of forming p- and n-type regions, by Hg vapor changes or simultaneous sputtering of dopants. Study trapping and noise phenomena in sputtered films using field-effect measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLOW AND FATIGUE FRACTURE OF TITANIUM ALLOYS

H. Margolin, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Metallurgy, *333 Jay St., Brooklyn, New York* 11201 (DN575245; N00014-75-C-0793)

This research effort will explore the flow and fatigue behavior of alpha-beta titanium alloys. It will develop needed understanding of microstructural effects in this important class of alloys used in naval vehicle structures and jet engines.

The yield and flow behavior of alpha-beta titanium will be examined in a series of Ti-Mn alloys with Mn adjusted to provide 1 to 100 percent beta. Alpha morphology and distribution will be varied and the associated effects on flow behavior noted. Low-cycle fatigue behavior of Ti 6-2-4-6 will be investigated for two strength levels at different sizes of equiaxed alpha and Widmanstatten alpha. Initiation, crack growth and crack path will be determined. Void formation in Ti 6-4 will be correlated with structure parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0015, MICROSTRUCTURE/PROCESSING CONTROL FOR ALUMINUM P/M WROUGHT PRODUCTS

J. Waldman, Aluminum Co. of America, Alcoa Technical Center, *P.O. Box 772, New Kensington, Pennsylvania* 15008 (DA0B0679)

The overall objective of this project is to investigate the interrelationship of process variable on the structure and properties of high-strength aluminum P/M wrought products. This objective is to be accomplished by two contracts (FY78 and FY79 funding).

This work is directed towards the technology area of armament with a major thrust of advanced armament concepts. In addition, the work is of importance to structural aircraft and helicopter parts, bridging and armor.

Based on the results of the FY78 contract, the proposed contract will involve producing wrought products from 3,200 pound billets of CT90 and CT91 alloys. Evaluation of the products will be in terms of the structure and engineering properties of the materials.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0016, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH-PERFORMANCE METAL-MATRIX COMPOSITES

H.L. Marcus, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DN875163; N00014-78-C-0094)

Metal-matrix composites offer promise for use in Navy airframe structures, turbine engines, missiles, armor, penetrators, etc. This research effort is directed towards understanding the structure-property relationships in graphite-reinforced aluminum composites which have demonstrated high strength-to-density properties, but suffer from low transverse strength.

The program is divided into three phases. The first phase will examine fracture behavior in graphite-reinforced aluminum composites. Chemistry of the fracture surface will be related to the fiber-matrix interfaces. The role of residual stress in influencing the fracture will be explored. A fracture criteria will be developed that will be used in the second phase of the program to give directions for structural change of the fiber-matrix interface by thermal treatment to improve transverse strength. The third phase will introduce modifications in the process fabrication variables to improve the mechanical properties further.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, DEVELOP METHODS FOR RESTORING AVIATION FUEL AMK MODIFIED BY ANTIMISTING POLYMER ADDITIVES

Unknown, U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command, *Fort Belvoir, Virginia* 22060 (FA78WAI-880; FA161225 (TRAIS NO.))

Develop a suitable method for restoring filtration, atomization and other essential properties to FM-9 antimisting fuel for use in aircraft turbine engines and fuel systems. Task I - Investigate, develop and measure FM-9 fuel restoration. Task II - Demonstrate effectiveness of degraders. Task III - Analysis and recommendations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0018, AN INVESTIGATION OF THE ELECTROCHEMICAL BEHAVIOR OF GRAPHITE FIBER-POLYMER COMPOSITES 16002-MS

G.E. Stoner, University of Virginia, School of Arts & Sciences, Dept. of Material Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DA0G8964; DAAG29-79-G-0027)

To study multiple interfacial electrochemical interactions within graphite fiber-polymer composite electrode materials to gain an understanding of the factors affecting stability and electrode performance. Relevance - this research is relevant to the design and construction of advanced fuel cell electrodes and matrices for the fuel cell program of MERADCOM, to on-going research to determine better anode materials for the cathodic protection of Army structures, and the degradation of graphite fiber-polymer matrix materials for missile and aircraft structural applications.

This research will include: (1) study of the roles of fiber composite electrode composition and structure in degradation in ionic media, and (2) electrochemical and microscopic evaluation of the stability and performance of electrodes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0019, STRESS-INDUCED EFFECTS UPON STRUCTURE AND PROPERTIES OF CARBON FIBERS 13485-MS

D.B. Fischbach, University of Washington, School of Engineering, Dept. of Ceramic Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (DA0E9045; DAAG29-78-G-0142)

To study the stress-induced physical behavior of carbon fibers and the detailed influence of microstructure on their piezoresistance and dynamic mechanical properties. This research is relevant to the Army's need for stronger, stiffer, and less expensive lightweight fibers for reinforcement for composite materials for Army aircraft, missiles, and electrical power storage and distribution. Graphite-reinforced metal matrix composites are being proposed for bridge supports, storage batteries, helicopter transmission housings, turbine fan blades, and parts of the super flywheel.

The program will include: (1) determination of the effects of various thermal treatments on structure and properties, (2) study of the structure and properties of new pitch-mesophase and CVD carbon fibers, (3) determination of the temperature-dependence of the dynamic mechanical relaxation effects in the range 100-500k, (4) characterization of the microstructure of carbon fibers using such techniques as electron microscopy, x-ray diffraction, magnetic measurements, and (5) formulation of an analytical anisotropic elasticity model.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0020, DEVELOPMENT OF HOLOGRAPHIC RECORDING MATERIALS

A.A. Friesem, Weizmann Inst. of Science, *P.O. Box 26, Rehovot, Israel* (DF138660; AFOSR-77-3421)

Photoplastics and photodielectric polymers exhibit a high potential as efficient, low-cost recording materials for holography. Development work is required, however, before these materials can be utilized. In this effort, recording materials needed to facilitate making real-time holograms will be developed. This will provide improved techniques for performing nondestructive inspection of aircraft to determine structural integrity.

Photoplastics and photodielectric polymers will be used and evaluated in holographic tests representing typical real-time recording arrangements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, IMPROVED COMBUSTOR DOME CHARACTERISTICS

Unknown, (No Supporting Organization Reported) (DN889814)

Investigate the nature of hot streak formation which results in flow field regions of high fuel concentration contributing to high pattern factor and adverse boundary layer reactions as a function of the fuel injector harmonic producing a need for preferential liner cooling. Based on cold flow and burning and mixing test rig results, the influence of dome aerodynamics and dome geometry on stoichiometric profiles will be defined.

Highly instrumented single and multi-injector sector rigs will be used to qualitatively assess the mixing reaction; i.e., the manner of fuel entrainment in a strong airflow pattern. Cold flow tests will be followed by quantitative measurements in a hot rig.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0002, CONTRAST ENHANCEMENT METHODS FOR VIDEO SYSTEMS

A.L. Thomas, Southern Research Inst., *2000 9th Ave. S., Birmingham, Alabama* 35205 (DA0G1060; DAAK40 C 0155)

Identification of contrast enhancement techniques which can best be implemented in an existing target acquisition technology program.

Conduct a literature search and engineering analysis of performance, cost, size, complexity, etc., to determine the best enhancement techniques for use in airborne acquisition systems.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0003, SYSTEM INTEGRATION AND FIN DESIGN

B.W. Douglas, U.S. Dept. of Defense, Army, Missile Research & Development Command, Advanced Systems Development & Manufacturing Technology Dir., *Redstone Arsenal, Bldg. 5400, Huntsville, Alabama* 35809 (DA0G1016)

Perform system integration investigations for the free flight demonstration rocket using the Hercules Inc. strip laminate motor. Establish requirements for the fin opening time. Maintain an error budget for the demonstration rocket. Design the shroud and fin assembly.

Conduct system trade-off investigations in accuracy for changes in spin rate, stability margin, delayed opening time of the fins, mallaunch rate, etc. Maintain an error budget with the rocket's sensitivity to each error source. Prepare the technical requirements and monitor an out-house contract for the design and fabrication of the time delay mechanization package. Design fins and provide fabrication drawings.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0004, EXPERIMENTAL STUDY OF THE CHARACTERISTIC PROPERTIES OF VARIOUS TURBULENT SHEAR FLOWS ENCOUNTERED IN SYSTEMS OF NAVAL INTEREST

A. Roshko, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DN623976; N00014-76-C-0260)

Since the flows over all naval ships and airplanes are largely turbulent, investigations which lead to a better understanding of such flows could result in significant improvements in the performance of naval craft. This experimental task will obtain data to develop phenomenological laws to predict the effects of density differences and pressure gradient on the turbulent processes so that reliable engineering estimates are available for design.

Experimental study of the properties of large coherent structures in turbulent shear flows, especially wakes, will continue, exploiting advances in concepts and techniques already made under this contract. In addition, effort will be directed at searching for large-scale coherent structures in a counterflow free shear layer in liquid helium II.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA

B. Sturtevant, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF048980; F49620-77-C-0107)

AF function - advanced weapons systems. Opportunity -understanding the behavior of vortex rings and propagation of weak shock waves through nonhomogeneous media. The large scale structure of turbulent flows are regions where the vorticity is concentrated and fluid motion is highly organized and coherent. The vortex ring is the simplest example of this type of motion. Understanding of the behavior of the vortex ring will provide valuable insight into the behavior of any turbulent boundary layer. In the analysis of the scattering of a weak shock wave in a fluid, the equations are reduced to those identical to the mean motions of turbulence. Thus the study of the scattering of a weak shock wave may provide insight into the nature of turbulence. Objective - to study the nature and behavior of ring vortices and the mixing processes of a nonhomogeneous medium induced by a plane shock wave. How work contributes - understanding of the dynamics of ring vortices and the propagation of nonlinear disturbances through a random atmosphere is essential to the understanding of turbulent boundary layers. This understanding has application in efficient air frame and wing design, the ability to produce more efficient combustion systems for advance power plants and gas dynamic lasers, the understanding of blast waves and sonic booms. In short, almost every fluid flow problem of interest to the Air Force.

A sharp, strong vortex ring will be produced by a shock tune. The characteristics and behavior of the vortex including the onset and type of instabilities will be studied using Schlieren and shadowgraph photography. A thermally tagged particle of gas will be used to mark a portion of the fluid to evaluate velocity and shear components and circulation within the vortices. A detailed comparison between the experimental observation and theoretical predictions will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, AIRBORNE OCEAN SURVEILLANCE AND RECONNAISSANCE TECHNOLOGY DEVELOPMENT

B. Jackson, General Dynamics Corp., Electronics Division, *P.O. Box 1950, San Diego, California* 92112 (DN881225; N62269-76-C-0130)

To continue the development and simulation of ANC (abrupt nonlinear compression) algorithms and extend the technique to include two-dimensional algorithms. To further investigate digital recording techniques with the laser line scanner. This contract supports work unit ZT701, Agency Accession No. DN781263.

Review the previous work done on one-dimensional ANC algorithms and determine the possibilities of improving the initialization procedures, reversal of relative temperature, and streaking effects. Develop two-dimensional algorithms using the same techniques used in the one-dimensional algorithm. Simulate the results using the laser line scanner and the infrared ship imagery data bank. Examine the feasibility of using the laser line scanner to recover digital data recorded on film.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - NONLINEAR DYNAMIC SUBSTRUCTURING TECHNIQUES AND IDENTIFICATION OF COLLAPSE MECHANISMS

K.C. Park, Lockheed Aircraft Corp., Research Lab, *3251 Hanover St., Palo Alto, California* 94304 (DN475448; N00014-74-C-0355)

The objective of this research is to develop efficient direct time integration strategies for large-scale non-linear dynamic analysis of Navy structures (ships, aircraft, submarines, missiles, etc.). The strategies require: an understanding of interactive characteristics of time integration methods with the attendant non-linearities in the system equations of motion; computer implementation of efficient error control and time-step changes; techniques to minimize computations per time-step and to maximize the time-step size within a permissible error allowance.

The three major attributes of a time integration package are the choice of integration algorithms, computer implementation, and error and step size control strategies. Algorithmic aspects affecting the efficiency of integration process have been investigated in the past two years under this contract. The effect of implementation can be assessed by a detailed examination of computational sequences which are taken at each integration step. Error and step size control strategies are based on the desired local accuracy of linear oscillatory components and on the rate of changes in nonlinearities. In addition, a hybrid (explicit-implicit) procedure is proposed to take advantage of both explicit and implicit schemes in one integration package.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC EXTERNAL STORE INTERFERENCE AND INTEGRATION

N. Malmuth, Rockwell International Corp., Science Center, *1049 Camios Dos Rios, Thousand Oaks, California* 91320 (DN875431; N00014-78-C-0477)

The problem of aircraft/external weapons aerodynamic interference is of major importance in the final performance of the aircraft as a weapons platform. This aerodynamic interference becomes even more critical with requirements to carry and release weapons at higher speeds. Historically, the aircraft configuration has been largely fixed before external weapons are added to the platform. This precludes any extensive platform configuration changes to minimize unfavorable aerodynamic interference and usually results in extensive model and flight testing to insure satisfactory aerodynamic integration and perfomance of the system. It is the objective of this project to study interference phenomena associated with aircraft/stores interactions at transonic speeds as a basis for development of simplified computational models for aerodynamic prediction.

The approach to achieve this objective will be to develop simplified semi-analytical/computational concepts to treat the store-pylon-wing interaction problem, correlate the simplified analytical concepts with the full three-dimensional computational model, and parametrically study the influence of pylon height, store size, wing sweep, and Mach number on system aerodynamic interference. In addition new aircraft/weapons integration concepts will be analyzed to investigate the potential for minimizing aerodynamic interference by including this integration at the early conceptual stage of aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, EVALUATION OF DATA ON VISCID-INVISCID INTERACTIONS IN TURBULENT FLOW

S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF052920; AFOSR-78-3659)

AF function - advanced propulsion and aerospace vehicle systems. Opportunity - assessment of computational methods for viscid-inviscid flow fields. Objective - to collect, classify and assess data available for turbulent flow fields. How work contributes - will provide a basis for determining range and reliability of different computational methods developed for turbulent shear flows.

The first task will be the collection of data sets. Then it will be assessed for significance, accuracy, and reliability. The data will be grouped into several related classifications in order to organize the topic and to relate data, computer models, and applications. Points to consider will include degree of flow complexity, flow types, and related applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, MODELLING ROLL SIMULATOR WASHOUT

H. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF320760; F33615-77-C-0508)

Considering the increased use of moving base simulators in the Air Force the requirement for better simulator design criteria based upon human operator technology is timely, but more research is needed in this area. A continuing effort to develop this type of simulation criteria technology is being pursued by AMRL (EM). A significant portion of moving base simulator design is the use of washout circuits to limit simulator motion. A criteria that can be linked to pilot performance is desirable. The objective of this research effort is to formulate an experiment that can accomplish this in the roll axis, perform the experiment, collect data and analyze the data. From the results, optimum washout design criteria and human operator models for the roll axis will be formulated. The results of this effort are needed by AFHRL, AFFDL, and AMRL for improved design of motion base simulators.

To have Systems Technology, Inc., assist AMRL/EM in the performance of experiments and model development and validation related to the effects of roll simulator 'washout' upon pilot behavior, performance, and subjective evaluations of realism and interference with control behavior. The intended effort can be divided into six phases: Phase 1, state-of-the-art critique, Phase 2, washout selection, Phase 3, experimental planning and liaison, Phase 4, data analysis, Phase 5, data interpretation and validation, and Phase 6, documentation. This work is being transferred from work unit 68930225.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0011, AERONAUTICAL RESEARCH, TECH AREA IV - RESEARCH IN MATHEMATICS

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0C5004)

The objectives are to exploit and apply state-of-the-art mathematics in support of laboratory research efforts; to develop a technology base in numerical analysis and computational techniques; and to advance mathematics in areas of rotary-wing fluid mechanics applicable to airmobile R&D.

The approach consists of three major steps: (1) maintain awareness of the development and disseminate state-of-the-art mathematics throughout HTE laboratory; (2) exploit new techniques and methods for assimilating the results of complex, time-dependent computations for airmobile applications; (3) conduct research in various applied mathematical topics which are relevant to Army needs. These objectives will be achieved largely through joint participation with NASA making maximum use of the facilities and expertise available within NASA with respect to computational fluid dynamics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

4.0012, FIRE-RESISTANT PARACHUTE CANOPY DEVELOPMENT

J.D. Boone, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN695433)

To improve the resistance of the personnel parachute system, particularly the canopy, to fire and radiant or connective heat. Goals are: (a) 10-second exposure to JP fuel fire with functional survival and (b) retention of no less than present performance capabilities.

The personnel parachute will be redesigned so as to use aromatic polyamides ('kevlar-29') instead of nylon and still remain within present parameters of weight, bulk, and performance. Chief obstacle is the non-availability of fine denier aramid yarn for canopy fabric. Review properties of candidate materials; redesign as necessary to take advantage or overcome undesirable properties of choosen materials; construct prototype components, canopy, and personnel parachute system; and test prototype, redesign as necessary, procure pilot lot and perform acceptance testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0013, AN EXPERIMENTAL AND ANALYTICAL STUDY OF BOUNDARY LAYERS IN HIGHLY TURBULENT FREE-STREAMS

R.P. Dring, United Technologies Corp., Research Laboratories, *400 Main St., East Hartford, Connecticut* 06108 (DF052270; F49620-78-C-0064)

AF function - advanced turbomachinery. Opportunity - improvement of present methods for predicting heat transfer and aerodynamics losses on cooled gas turbine blades. Objective - determine the influence of free-stream turbulence level on the heat transfer and profile development of 1) two-dimensional, fully turbulent, zero pressure gradient boundary layers and 2) two-dimensional, accelerating transitional boundary layers. How work contributes - will provide data to modify current turbine air-

foil aerodynamic and cooling design systems so they will more accurately account for the entrainment of free stream turbulence energy into boundary layers and for the combined effects of acceleration and free stream turbulence on the boundary layer transition process.

An experimental program will be performed and data obtained for fully documented boundary layer flow for various turbulence levels and free stream velocities. Following this similar data will be obtained for transitional boundary layer flow. The data obtained will then be compared to the predictions obtained from the UTRC finite-difference boundary layer calculation method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, HIGH-TEMPERATURE ELECTRONICS TECHNOLOGY

J.E. Davey, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880152)

To investigate device and integrated circuit performance as related to direct utilization in naval aircraft engine control functions at ambient temperatures up to 300 deg. C. The program will integrate existing high-temperature performance data with that obtained from representative members of the full family of devices and circuits required for engine control at 300 deg C. Reliability and performance limiting factors are to be determined. The full program is to include all promising high-temperature semiconducting materials.

This effort is considered to be integral to a long range NAVAIR program on improved devices and related technology pertaining to naval aircraft requirements. As such, it is expected that initial phases will be expanded as progress and more advanced requirements warrant. Initially the program will investigate silicon devices and integrated circuits for the high-temperature application; performance and reliability factors will be determined. A second year follow-on and parallel phase will examine GaAs devices and integrated circuits with the same emphasis. An additional program may be also initiated to examine the fundamental limitations of these and other contender materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0015, ELECTRONIC DEVICES AND CIRCUITS FOR USE IN NUCLEAR ENVIRONMENTS

H.L. Hughes, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620084)

The Navy has a continuing need for semiconductor devices and circuits which can function reliably in satellite, missiles and ship systems exposed to severe nuclear radiation environments. The objective is to provide the nuclear vulnerability assessment of devices in such Navy systems as well as provide techniques for the fabrication of radiation-hardened semiconductor devices and circuits.

The approach is to develop a complete family of radiation-hardened metal-insulator-semiconductor (MIS) and bipolar LSI/VLSI technologies. Since the most radiation-susceptible region of such devices is the insulator-semiconductor interface, techniques to reduce this sensitivity are being pursued. Silicon dioxide and silicon nitride films with highly controlled electrical properties are being deposited on silicon GaAs, and InP device substrates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0016, ANALYSIS OF SOLID-PROPELLANT FIRE ENVIRONMENT

E.W. Price, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF192720; F29601-78-C-0054)

To more clearly define the solid-propellant fire environment associated with launches of nuclear material for use in space power systems with possible applications to the design of materials to be used in future systems.

Perform combustion experiments using UTP-3001 solid propellant to determine the characteristics of the combustion zone including the smoke plume. This will include modeling of the burn rate, characterization of the thermodynamics and heat transfer in the combustion zone, analysis of the aluminum and aluminum oxide interactions, and temperature measurements of the combustion zone.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0017, TRANSITION TO TURBULENCE IN SHEAR LAYERS

M.V. Morkovin, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Mechanical & Aeron Engineering & Mechanics, *3300 S. Federal St., Chicago, Illinois* 60616 (DF046500; F49620-77-C-0013)

AF function - improved aerospace vehicles. Opportunity - increase understanding of the transition to turbulence in shear layer phenomena. Objective - prepare a self-contained comprehensive and reliable guide to the phenomenon of transition to turbulence in shear layers for use by research workers and designers. How work contributes - it will provide an understandable, comprehensive, and reliable guide on transition to turbulence in shear layers for designers to use in future aerospace vehicle designs.

All information presently available in the open literature will be collected, analyzed and organized into a self-contained monograph on transition to turbulence in shear layers. The text will identify what is considered solid, established information, what are tentative concepts based on limited evidence, and what are conjectures and speculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, CONTROLLABILITY AND EVALUATION OF COHERENT STRUCTURES IN TURBULENT WAKES

J.L. Way, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Mechanics & Mechanical & Aerosp Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DF036430; F44620-76-C-0062)

AF function - advanced aerospace vehicles. Opportunity - gain a better understanding of the underlying concepts of turbulent wakes. Objective - to provide data for the use of predictive schemes and answer basic questions concerning the character and evolution of large-scale structures in turbulent flows. How contributes - will provide data and insight for the various sophisticated predictive schemes to be tested against prior to being used in the design of advanced aerospace vehicles.

Three contrasting basic wake geometries will be studied first, to be followed by combinations of the basic geometries that produce the most interacting flows. The experimental techniques of thermal tracing, conditional sampling and averaging, and acoustic excitation will be employed to extract information for predictive theory testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, MULTIPLE PHOTON PUMPING OF MOLECULAR LASERS - FREQUENCY TUNABLE AND FAR IR LASERS

P.D. Coleman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF000190; AFOSR-76-2988)

AF function - improvements in the operation of AF communication and surveillance equipment may be brought about by advances in electro optical techniques and electromagnetic devices. Research on infared optical electronics and tunable lasers in this region will contribute important results for the use of this part of the electromagnetic spectrum in communications, optical radars and diagnostic techniques. Opportunity - previous work has provided the knowledge and the facilities to develop and explore the

mid- and far-infrared spectral region (10-1,000 micron wavelength). Specific problems are nonlinear spectroscopy of molecular gases with the aim of developing frequency tunable sources, frequency convertors, and mixers. Objective - the thrust of this work is obtaining a frequency tunable source in the near- and far-IR via nonlinear optics. A study of a three photon-four level tunable Raman system and a study of a four photon-four level parametric system will be made. Contribution - for many applications, low-level cw frequency tunable signals are useful. For example, in spectroscopy or resonance studies, in evaluating the bandwidth characteristics of devices, and in local oscillators these signals could be used to advantage. In other applications, high pulsed power tunable signals are needed, such as in optical pumping experiments, double resonance studies and systems applications.

Previous research has contributed important information on optical pumping and infrared integrated optics. Sufficient progress has been made to permit further studies of frequency tunable laser sources in the infrared and to develop integrated optics. This research will focus on methods of obtaining frequency tunable coherent sources in the far-IR spectral range. The specific phases of the work include: (1) a study of a three photon-four level tunable Raman system, (2) a study of a four photon-four level parametric system, (3) a density matrix analysis for guiding the work and for correlation with experimental results, and (4) a study of single and double harmonic mixers to measure small far-IR frequency offsets, frequency shifts and frequency chirping.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, AN IMPROVED NONLINEAR DYNAMIC ANALYSIS OF FLAT PLATE LAYERED BODIES ACCOUNTING FOR LARGE TRANSVERSE DEFORMATION

A.R. Zak, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DA0Q4503; DAAD05-77-C-0722)

First objective is to improve on existing finite element program (TIP) so as to obtain a more realistic determination of stress and deformation. The second objective is to reduce the execution time of the program.

The approach is to improve the constitutive equations used in the present tip program and, if possible, modify the formulation of the problem so as to reduce the execution time.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

4.0021, ELECTROMAGNETIC PULSE INTERACTIONS WITH HOLLOW BODIES MADE OF ADVANCED COMPOSITE MATERIALS

K.F. Casey, Kansas State University, School of Engineering, Dept. of Electrical Engin, *Anderson Hall, Manhattan, Kansas* 66502 (DF043380; AFOSR-76-2980)

AF function - this investigation will assess the effectiveness of advanced composite materials used as shields against unwanted penetration of electromagnetic energy which may occur as a consequence of a nuclear electromagnetic pulse or other cause. Opportunity - this study may provide a basis for technological progress in the use of advanced composite materials in aircraft structures. Objective - this research will examine the coupling relationship between surface fields and the descriptive integral equations for equivalent surface current densities on selected composite materials. Contribution - the proposed research will provide a basic theoretical investigation of the properties of advanced composite materials.

This study proposes to explore the coupling relationship between surface fields and the descriptive integral equations for equivalent surface current densities on selected composite materials. This relationship will be applied to fields on a hollow shell.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, THERMOMECHANICAL STRESS ANALYSIS OF ADVANCED TURBINE BLADE COOLING CONFIGURATION

D.J. Shippy, University of Kentucky, School of Engineering, Dept. of Engineering Mechanics, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF040950; AFOSR-75-2824)

AF function - to contribute to the sum of total knowledge regarding thermal effects for engine components of modern aerospace vehicles. Deficiency - there is a lack of scientific understanding concerning heat transfer for complex and advanced Air Force turbomachinery. Objective -this research effort will attempt to fully evaluate stress distributions for a transpiration-cooled gas turbine engine blade. How work contributes - if more is known about the problem of thermomechanical stresses in the vicinity of a cooling hole for a turbine blade, better Air Force flight systems and components will surely evolve.

Through the use of the boundary integral equation method (BIE), the problem of a thermomechanical stress near a cooling hole in a turbine blade is analyzed. Manufacturing 'realities' of multiple holes, temperature-dependent elasticities, anisotropic effects, viscoelastic effects and the influence of cracks are also considered. The principal investigator will initiate an investigation of orthotropic and anisotropic material modeling for similar classes of thermoelastic problems using the BIE approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, FLUIDIC SEQUENCER FOR SEAT EJECTION

J.M. Goto, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0F5580)

To assist in the evaluation/demonstration of the feasibility of utilizing fluidics to obtain longer installed life and improved accuracy and reliability in the sequencing of seat ejection systems.

To assist the Naval Ordnance Station personnel by evaluating contractor-designed fluidic circuits and components, attend contractor program reviews, and help study the feasibility of using a 'continuous sensing' mode for aircrew escape system event sequencing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0024, BASIC LAB SUPPORT - ULAIDS

D.M. Watters, U.S. Dept. of Defense, Navy, Naval Air Test Center, *Patuxent River, Maryland* 20670 (DN793251)

To provide technical support and hardware to integrate the Universal Locator Airborne Integrated Data System (ULAIDS) into the basic V/STOL laboratory.

Conduct joint NADC/NavAirTestCen systems integration studies and provide ULAIDS hardware for systems integration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0025, NAVIGATION - TWO-COLOR REFRACTOMETER

D.G. Currie, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775533; N00014-77-C-0541)

The objective of this work unit is to develop a new astronomical technique which will directly measure the effects of the atmosphere on the apparent positions of stars thereby allowing the determination of stellar positions with an accuracy significantly better than 0.1 arc-second in a single observation which is of interest to the Navy for improved navigation and guidance.

This experiment involves the measurement of the apparent position of a star at two widely separated wavelengths thereby permitting one to use the difference in apparent position to determine the total effect of the atmosphere on the apparent position of stars. Data will be taken under a variety of atmospheric conditions and locations. The validity of this approach will be determined by examining the internal consistency of the data as well as comparison with the results of other measurements where atmospheric effects have been corrected in other ways.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0026, RAMAN LIDAR FIELD TESTS

D. Leonard, Computer Genetics Corp., *4 Lake Side Office Park, Wakefield, Massachusetts* 01880 (DN781308; N62269-76-C-0302)

To demonstrate accurate correlation of Raman lidar, and radiosonde measurements. This contract supports work unit RG704, Agency Accession No. DN 681244.

Field tests will be performed at NASA Langley, utilizing Raman lidar equipment to demonstrate water vapor concentration, temperature and transmission profile measurement capability. Additional measurement capabilities such as wind velocity and aerosol concentration will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0027, CONTINUED STUDIES OF MAGNUS PHENOMENA ON SPINNING AND CONING BODIES 15815-E

E.E. Covert, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G8938; DAAG29-79-C-0002)

To study magnus forces and moments using a magnetic support and balance system for producing simultaneous spinning and coning motion. Relevance - the proposed investigation is directly relevant to the flight stability of mortars, small arms, and large projectiles.

System improvements will be made to provide better model position stability, better data signal-to-noise ratio and wider operating range of coning angles, coning frequency and spin rate. Detailed measurements will be carried out in which coning frequency and amplitude, spin rate and Reynolds number would be varied for several axisymmetric projectiles of interest.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0028, PASSIVE RING RESONATOR LASER GYROSCOPE

S. Ezekiel, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF044120; AFOSR-76-3042)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. Deficiency - the coming use of ring lasers in platform and strapdown systems poses problems of cost, size and reliability. Objective - the intrinsic limitations of the ring laser are to be avoided by new approaches to angular rate sensing using optical means. How work contributes - the new device should be free from locking and bias drift effects usually encountered in conventional laser gyros and should allow size reduction without sacrifice of sensitivity.

Investigation of the limitations of a new laser gyroscope which uses a passive ring resonator as the rotation sensing element and two independently controlled laser frequencies to read out the lengths of the clockwise and counterclockwise paths of the resonator. A sensitivity of one milli-earth-rate is anticipated in an integration time on the order of 100 seconds. Because the laser is outside the ring interferometer, solid-state GaAs lasers may be used which would make the gyroscope small in size.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, ENERGY CONVERSION - COMPRESSOR BLADE FLUTTER MEASUREMENT USING RETROREFLECTORS

J.L. Kerrebrock, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN775111; N00014-77-C-0106)

The objective of this project is to assess the viability of compressor blade flutter measurements utilizing a retroreflector technique under development at Aerodyne Research, Inc. The effort is experimental in nature and is aimed at direct measurements of aerodynamic damping coefficients in terms of interblade phase angle, tip Mach number, and pressure ratio. This research will contribute to an increased understanding of the effects on performance of one of the limiting factors in the design of fan and compressor blades (blade flutter), and hopefully result in increased performance of gas turbine engines needed for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

An instrument designed, built, and calibrated by Aerodyne Research, Inc. Will be procured by the M.I.T. gas turbine laboratory. It will be utilized in an M.I.T. blowdown compressor to conduct blade flutter measurements for correlation with conventional on-going flutter research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0030, DEVELOPMENT OF IMPROVED MASS RATE OF FUEL FLOW TRANSMITTER FOR FUTURE NAVY AIRCRAFT

L. Lynnworth, Parametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DN881388; N62269-77-C-0363)

The general objective of this task is to further develop Navy capability to define and specify jet engine fuel system components for advanced types of Navy aircraft in the 1980 era. Future naval aircraft, and in particular the V/STOL, will require both airframe and engine sensors that are improvements over the current state of the art. This comes about as a result of the V/STOL flight regime which is very demanding especially in the area of fuel management. With fuel management judged to be increasingly critical, and engine diagnostics a distinct possibility for V/STOL, the need exists for a fuel flow transmitter having a high degree of accuracy and day-to-day repeatability. This contract supports work unit ZA601, Agency Accession No. DN681080.

Manufacturers of this type of equipment were contacted via RFP containing a work statement embodying those requirements necessary to meet the objective.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0031, ROCKET CHARGING STUDY

H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249280)

AF function - communication satellites in geosynchronous orbit. Deficiency - electrical charging of satellites by ambient particles causing anomalous switching of electronic circuitry. Objective -development, testing and use of charge ejection systems to duplicate, prevent, or control satellite charging. How research contributes - by the development, testing and use on space vehicles of charge ejection systems, charging of satellite surfaces can be controlled for predetermined periods, obtaining either large or small potential differences with respect to ambient plasma.

A sounding rocket payload is being prepared for flight. This payload will have the dual purpose of obtaining a relationship between the charge ejected from a space vehicle, ambient parameters, and the resultant charge on the vehicle surface, and the testing of the satellite positive ion beam system to be used on the SCATHA satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0032, UNSTEADY SHOCK WAVE MOTION IN TRANSONIC FLOW

T.C. Adamson, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DN790024; N00019-77-C-0263)

To study the unsteady motion of shock waves in two-dimensional transonic channel flow.

Computer solutions developed during the previous contract year will be used in making a short (one to two minutes) movie film illustrating unsteady flow with a shock wave in a two dimensional symmetric channel; the unsteady behavior will arise as a result of oscillatory pressure pulses introduced in a plenum downstream of the shock wave. Next, the study of the characteristic time for the formation and collapse of a shock-induced separation bubble will be completed. Finally, an attempt will be made to use methods developed previously to develop criterion for incipient separation induced by an oblique shock wave impinging on a flat plate turbulent boundary layer in transonic and in supersonic flow; the extent to which this analysis will be carried out will depend upon the time remaining after completion of the first two tasks.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0033, LASER HARDENING THROUGH FLUID MECHANICS

H.W. Kipp, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF133150; F33615-78-C-3002)

Air Force vehicles operating at moderate to high speeds may be subjected to laser attack in the near future. This induced thermal environment must be properly considered in the design process of future vehicles. Methods by which this threat may be countered or reduced must be explored. This work unit will explore the possibility of dissipating laser energy at the vehicle's surface through techniques of fluid mechanics. By ejecting a fluid into the boundary layer over critical vehicle components the laser energy may be dissipated thereby protecting the vehicle from critical damage and assuring mission success.

Through both experimental and analytical means this work unit will investigate the interactions between fluid flowing over a surface and various levels of impinging laser energy. Different fluids will be examined as a means of dissipating the laser energy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0034, DIGITAL DATCOM IMPROVEMENT

J.E. Williams, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF140200; F33615-77-C-3073)

This work unit supports TPO 3, Flight Control, and major thrust FG02B, Flight Control System Design Techniques. Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The objective of this work unit is to extend the capability which now exists in the USAF stability and control digital DATCOM by: (1) updating the program to agree with the 1976 revision to the USAF stability and control DATCOM, (2) improving the implementation of the transonic methods, and (3) reducing engineering analysis time by modifying the input and output characteristics. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design.

Computational method modules will be updated to reflect the latest revisions to DATCOM, to provide non-linear fairing of transonic output, and to incorporate a standard atmosphere model. Input requirements will be made more flexible by permitting altitude and flight speed to be specified in lieu of Mach number and Reynolds number, and expanding the addressable configurations by allowing ventral fins. Output interpretation will be simplified by introducing a plot option and by greatly condensing the extrapolation warning message output.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0035, NAVY VEHICLE DESIGN AND CONSTRUCTION - VISCOUS FLOW FIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT

W.W. Bower, McDonnell Douglas Corp., Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675330; N00014-76-C-0494)

Develop the numerical techniques for predicting viscous, turbulent flow produced by the operation of high performance lift-jet VTOL aircraft in ground effect. These techniques will provide fundamental information on jet entrainment, temperature and velocity decay, and ground jet growth. This information will permit accurate prediction of induced forces acting on the airframe which are required for propulsion system sizing and aircraft stability and control analysis.

The numerical technique developed in the previous phase of this investigation for steady, 2-D, compressible, turbulent, vectored and unvectored impinging jets from fuselage-like bodies will be extended to the imcompressible 3-D case. Two jet geometries will be considered. An isolated axisymmetric jet included to the impingement surface will be analyzed. In addition, the flow field interactions of two axisymmetric surface will be analyzed. In addition, the flow field interactions of two axisymmetric jets which impinge on a ground plane perpendicular to the jets will be computed. A one-equation turbulence model will be developed for 3-D flows. Results will be compared with data generated in a complementary experiment being conducted at McDonnell Douglas research laboratories.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0036, FAR INFRARED MERCURY-CADMIUM TELLURIDE PHOTOCONDUCTIVE DETECTORS

C.J. Summers, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF052420; F49620-78-C-0072)

AF function - secure space communication and covert optical electronics require devices which exploit the properties and interaction effects of materials with far-infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - the objective is to improve current-detector performance by more than an order of magnitude at long wavelengths by utilizing the effect of moderate magnetic fields on increasing the lifetime of photoexcited excess-electrons in HgCdTe alloys at low temperatures. A systematic study of the far-infrared photoconductive lifetime in HgCdTe as a function of alloy composition, charge-carrier concentration, temperature, and magnetic-field strength is being undertaken to quantitatively establish the role of magnetic fields in enhancing long-wavelength characteristics of HgCdTe detectors and to identify the responsible physical mechanisms. Electron and crystal-lattice interactions that are independent of magnetic fields but which limit photoconductive lifetimes at long wavelengths will also be investigated. Calculations will be made of the magnetically enhanced performance of HgCdTe detector configurations and of the long-wavelength limits for detector operation. How work contributes - it is expected that this work will lead to the development of high-performance (magnetically enhanced) photoconductive detectors for 15-50 micron radiation. Performance enhancement at long wavelengths is anticipated also for line and square detector-arrays for sensitive targeting operations in space, where a distant, relatively cold object must be sighted and tracked against a space or terrestrial background.

Photoconductor-grade, n-type, single-crystalline, HgCdTe specimens selected on the basis of crystalline quality and compositional homogeneity, with ranges of alloy compositions and conduction-electron concentrations will be electrically and optically characterized. Photo-Hall-bar elements will be fabricated, and their photoconductive properties, including lifetime, will be measured for 5-300 K temperatures under controlled background conditions. Magnetophotoconductivity measurements will be made on specimens for which the electron lifetime is limited by Auger recombination. Selection rules will be investigated by performing measurements in both the Faraday and Voigt configurations. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, NUMERICAL SUPERSONIC FLOW FIELD STUDIES FOR NAVAL AIRCRAFT AND MISSILES

S.I. Cheng, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box*

430, Princeton, New Jersey 08540 (DN123280; N00014-75-C-0376)

The development of accurate methods to compute the flow fields about wings and bodies for complex flow situations is essential for the aerodynamic design of aircraft and missiles. In the proposed investigation, the flow over a yawed cone and the interaction of a shock wave with a boundary layer will be studied within the framework of the Navier-Stokes equations. The cone problem is representative of the flow over the forward portion of a maneuvering missile or aircraft and the shock wave study is representative of transonic flow on an airplane wing.

Many complex flow situations about aircraft and missiles cannot be calculated with reliability by existing theory. Developments in computer technology together with advances in numerical methodologies now make the study of these complicated flows, within the framework of the fundamental equations of motion, an extremely attractive and fruitful approach. Major emphasis will initially be on the shock-boundary layer interaction problem. Both laminar and turbulent boundary layers will be treated; a phenomenological model will be used to describe the turbulent layer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, NAVY VEHICLE DESIGN AND CONSTRUCTION - DISPLAY IMAGE DESCRIPTORS

R.W. Cohen, Radio Corp. of America, David Sarnoff Research Center, *Washington Rd., Princeton, New Jersey* 08540 (DN475203; N00014-74-C-0184)

This task is to develop improved displays for Navy flight vehicles by formulating a set of descriptors that includes the transfer characteristics of human visual system and which are suitable for specifying a variety of imaging systems. The primary use of the descriptors is expected to be in the design and the evaluation of imaging systems by allowing designers to predict, for a given set of viewing conditions, observer reaction to changes of various display characteristics.

The contractor has developed a mathematical approach to display characterization based on information theory, experimental data from psychophysics, and image analysis. The approach will include analysis of one- and two-dimensional sampled displays, the effects of chrominance, and conclude in this phase with the demonstration of the applicability of the image quality parameters to a wide variety of display formats and the presentation of the results in a simple, practical format.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0039, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLUTTER OF AXIAL-TURBOMACHINE BLADING

F.A. Sisto, Stevens Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *Castle Point, New Jersey* 07030 (DN923286; N00014-76-C-0540)

This research covers theoretical analysis and experimental measurements of self-excited and forced vibration aspects of typical gas turbine compressor blading. Such vibration, 'blade flutter', leads to gross mechanical behavior problems and to failure in meeting full design requirements for aircraft jet engines. Hence, this research contributes to assuring optimum jet engine performance at maximum rated power, and hopefully to increased life and reliability of military engines.

The investigation aims at acquisition of accurate experimental blade flutter data from annular cascade rigs incorporating suitable test sections, blowing equipment and variable guide vanes and blading. The many geometric, aerodynamic, vibratory parameters affecting nonstationary aerodynamic lift and moment coefficients are considered. A rotor rig is nearing completion which will have greater accuracy (vs a strator rig) in procurement of aeroelastic data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0040, NON-DESTRUCTIVE EVALUATION (NDE) FOR ADVANCED AIRFRAME CONCEPTS

R.C. Deitrich, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN896006)

To ascertain and characterize the intermediate and organizational level inspection criteria peculiar to composite airframe structures.

Define modes of deterioration and/or failure for composite airframe structures and evaluate techniques of NDT such as mechanical impedenance, acoustic emission, ultrasonics, n-ray, microwaves, thermographics and eddy current for applicability and effectiveness of detecting such flaws.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0041, TRANSONIC SHOCK-WAVE BOUNDARY LAYER INTERACTIONS

R.J. Vidal, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF043010; F44620-76-C-0057)

AF function - aerospace vehicles. Deficiency - present scaling techniques have not proven adequate in the extrapolation of transonic wind-tunnel data to predict full-scale aerospace vehicle performance. Objective - to determine the importance of Reynolds number effects and, in particular, unit Reynolds number and local Mach number effects on the shock wave boundary layer interaction at transonic speeds as an aid to providing adequate scaling techniques (modeling rules) for transonic testing. How work contributes - this research will help define the effects of Reynolds numbers and, in particular, the importance of more subtle effects inherent in the laboratory simulation of high Reynolds number flows (such as unit Reynolds number effects, heat transfer effects, local Mach number effects, axial pressure gradient effects, etc.) as an aid to developing more accurate scaling (correlation) and interpretation of laboratory data for full-scale aerospace vehicle design analysis and performance prediction.

Using a Ludwieg tube in which an airfoil pressure distribution with an interacting shock wave is impressed on a flat plate, the interaction of the shock wave with a fully developed turbulent boundary layer is investigated at transonic speed at discrete airfoil chord Reynolds numbers characteristic of current transonic wind tunnels (about three million) to full-scale Reynolds numbers (about one hundred and fifty million) measurements to be made include surface pressure and skin friction, Pitot static surveys across the interaction zone and Schlieren observations of the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0042, COHERENT HIGH-RESOLUTION IDENTIFICATION PROCESSING

B. Moritz, Measurement Concept Corp., *Rome, New York* 13440 (DF741900; F30602-77-C-0146)

The objective of this effort will exploit existing and future wideband microwave radar imaging technology and probe in depth into the near real-time image storage, comparison, and identification problem. The contractor will perform an analysis of methodologies for the collection and minipulation of new radar images and the specification of the data library and classifier requirements for a laboratory test bed system. Future system configurations will be emphasized. This program addresses the aircraft image identification phase of the overall tactical target identification (TTI) problem using the data processed from a wideband microwave radar system. In particular, this program will investigate the feasibility of various schemes and result in recommendations for future tactical radars. There are no tactical radar systems today which are equipped to image and identify non-cooperative aircraft. This deficiency is elaborated in TN-ESD-AFCRL-RADC-1709-69-07 AWACS IFF).

This study is an early effort in a new and sophisticated technology. The contractor will study and evaluate concepts developed by the government and others and upon review of available radar source data documentation, shall perform a detailed analysis and design to convert a variety of radar data formats into a common format to facilitate the image identification

process. This effort shall include consideration of sources from analog recordings and computer target simulations in addition to digital RTI recordings from several sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0043, MAINTENANCE EFFECT ON TURBINE ENGINE EMISSION

Unknown, Pan American World Airways, *Jamaica, New York* 11430 (FA78NA-5052; FA161522 (TRAIS NO.))

In relationship to the Clean Air Act and the Clean Air Amendment of 1970, FAA is concern about the emission level of newly manufactured engines and their change with operating hours. This studys objective, therefore, is to investigate and determine to what extent turbine engine exhaust emissions are effected by major engine maintenance on fifteen engines. Specific areas of interests to be investigated are 1) engine maintenance; 2) engine probes; 3) Jet A fuel usage; 4) test procedures; and 5) emission sampling equipment.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0044, NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATIONS FOR COMPLEX CONFIGURATIONS

S.G. Rubin, Polytechnic Inst. of New York, Long Island Center, School of Engineering, Dept. of Aerodynamics & Mechanical Engineering, *Farmingdale, New York* 11735 (DN524858; N00014-75-C-0511)

An accurate and detailed knowledge of the flow fields about naval aircraft and missiles is essential for the design of new and advanced systems. This theoretical investigation will develop and exploit new numerical procedures for solving the equations of motion to describe aerodynamic flows for all speed ranges with emphasis on transonic and supersonic speeds.

Numerical techniques for the solution of the equations of motion for continuum flow will be developed with particular emphasis on practical accuracy, resolution of detail in the flow field, and the efficiency of computing. Attention will be devoted to the calculation of combined viscous-inviscid flow fields about complex bodies at high Reynolds numbers. The approach will utilize the Euler equations and the boundary layer equations in a unified fashion so that both flows will be calculated in a single frame of reference. Initially two-dimensional and axially symmetric flows will be considered to develop procedures which can then be applied to an elliptic cross-section delta wing. Flows with and without separation will be treated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0045, MIXED BOUNDARY VALUE PROBLEMS OF ELASTICITY 13567-M

R.P. Srivastav, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (DA0E9077; DAAG29 76 G0197)

To develop analytical and numerical techniques for mixed boundary value problems of elasticity pertaining to fracture mechanics. The work is highly relevant to Army problems involving brittle fracture which has become a basic concern in structural design of gun tubes and helicopters. The proposed mathematical analysis of crack problems may thus contribute to a better understanding of fracture of structural materials.

Techniques will be drawn from Fourier analysis, multiple integral equations and analytic function theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0046, ADVANCE DEVICE PROCESSING TECHNIQUES

J.H. Bloom, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902780)

AF function - communications and reconnaissance. Deficiency/opportunity - solid-state components are too expensive. Objective - research new device processing techniques that improve the control and tolerance attainable in solid-state device fabrication. How research contributes - solid-state devices that are fabricated with processes that require reduced tolerance margins can be made cheaper due to increased yield and/or increased functional complexity per chip.

Electron beam exposures of electron resists, ion implantation doping, plasma and ion etching, and electron beam evaporations as well as ion sputtered thin films will be investigated for use in solid-state device fabrication. Fundamental physics of low barrier height Schottky barrier will be investigated as a function of processing techniques. electron beam dose requirements for submicron linewidth will be investigated as a function of available electron resist sensitivity and substrate material, i.e. Semiconductor, metal or insulator. Ion implantation doping of InP and various ternary compounds will be carried out to detezmine doping efficiency as a function of annealing temperature and capping material. Plasma and ion beam etching will be investigated in order to increase uniformity of the etched layers and improve selectivity. Various thin film techniques will be utilized to improve the junction quality of low work function Schottky barriers on silicon and to produce capping layers for III-V compounds semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0047, DEVICE HARDENING

W.M. Shedd, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903660)

The objective of this effort is to maximize the tolerance of semiconductor devices and integrated circuits to the radiation from both nuclear explosions and the natural space environment. This will be accomplished by maximizing the radiation resistance of devices and integrated circuits through the use of improved materials and processing techniques, new device designs, and hardened circuit design techniques. this effort is intended to provide the integrated circuit design and fabrication techniques for radiation hardened electronics.

A radiation hardened CCD signal processor will be developed to demonstrate the ability of CCD devices to perform in a radiation environment up to the lieits of available MOS technology. A program to develop an improved dielectric isolation technology for radiation hardened circuits will begin. Techniques will be developed for improving the area over which tightly controlled thickness for device pockets can be maintained. A study will be performed to determine the most promising technology for radiation hardened microprocessors. SMOS/SOS technology will be improved to obtain radiation-hardened LSI. Further work will be done to improve SOS technology to reduce back channel leakage currents, improve gate protection circuitry, and increase device yields.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0048, ELECTRICALLY SMALL ANTENNAS 13331-EL

C.H. Walter, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engin, *190 N. Oval Dr., Columbus, Ohio* 43210 (DA0S5575; DAAG29 76 G0067)

To study theoretical and experimental aspects of electrically small antennas. Relevance - the results will be applicable to reduced silhouette antennas such as used on manpack, vehicles, helicopters, antenna camouflage and antennas mounted on missiles or projectiles.

Determinations will be made of (1) limitations of electrically small antennas, and trade-offs between size, shape, signal-to-noise ratio, efficiency, pattern, power handling and bandwidth, and (2) effects of nearby conducting and dielectric matter.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0049, HIGH-TEMPERATURE HEAT TRANSFER TEST PROGRAM

J.A. Vonada, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460310)

To test, analyze and evaluate hot section components for advanced turbopropulsion applications. Typical applications include evaluation of high-temperature turbine vane/blade cooling schemes and testing of advanced materials and coatings. To analyze high gas and material surface temperature measurement concepts.

In the initial facility application, turbine vane cooling concepts are evaluated by mapping thermal contours of the vanes using infrared techniques. A color data pyrometer observes vane temperature while the desired test conditions are varied. An IBM 1800 computer is used for data acquisition. Temperature and pressure measurement concepts are evaluated during vane tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0050, AVIONICS LIFE-CYCLE COST

R. Harris, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF098130)

Obtain and develop costing methods, models and data base for evaluating and predicting avionics development, acquisition and logistics support cost elements. Apply methods, models and data base to life-cycle cost analyses in support of AFAL programs. The capability to evaluate and predict avionics cost-of-ownership will provide for the integration of cost factors in the design trade-off process thereby leading to a proper and acceptable balance between avionics performance and cost.

The approach to be taken in pursuit of stated objectives includes the following activities: (1) develop data base for logistics support cost experienced by present systems utilizing AFLCS IROS (K-051) data files, (2) develop data base for acquisition of present systems, (3) develop data base establishing non-recurring (R&D) portion of program unit cost of acquisition, (4) develop predictive cost models or estimating relationships (ERS) for system development, acquisition and logistic support using historical data relating performance, production and reliability trends and associated cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0051, BLUE TEAM SUPPORT FOR ECCM

E.W. Muschell, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF110210)

The objective of this effort is to test low-cost ECCM fixes for the F-4. This encompasses ground and flight tests of both existing industry-supplied devices and in-house developed ECCM techniques.

Program will parallel previous efforts on coronet buzz and giant filter programs. In past, emphasis has been on integrating equipment already onboard in new ways. The F-4 has far fewer radar equipments to exploit in this manner. Thus emphasis will be on testing of contractor-supplied noise cancellation circuitry. Any industrial ECCM device tested on this effort must have previously undergone lab or field testing against a threat signal equivalent to spot or barrage noise jamming. Thus contract funds are intended to cover field testing, not development. Two testing phases are planned: a ground test of several candidate fixes with the F-4 radar installed in a tower facility, followed by flight test of the superior performers. A ngn-hardware contractor will be hired to operate and maintain the F-4 radar, provide simulated ECM signals and carry out test procedures established by AFAL. AFAL personnel will evaluate results of ground testing and select the most promising candidates for flight test. Flight testing will be performed at Nellis AFB or other suitable locations, following procedures similar to giant filter and coronet buzz tests, final product will be test data supplied to TAC and AFLC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0052, AERODYNAMIC CONFIGURATION DEVELOPMENT

J.L. Terry, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF131400)

Advanced systems for air defense, tactical and strategic purposes require vehicles that operate at increased speeds and operational efficiency. The next generation of aerospace vehicles face technological deficiencies in such areas as aerodynamics, propulsion and materials. Because of increased complexity, early identification and resolution of significant problems are required to reduce acquisition costs and development time. The objective of this effort is to define aerodynamic configurations incorporating advanced technologies to establish a firm data base for the purpose of transitioning technology into future military aerospace vehicles.

The technical areas of aerodynamics, heating, propulsion, materials, stability and control and cockpit visibility will be evaluated during generation of conceptual configurations. The feasibility of applying new technologies will be assessed continually. The aerodynamic and performance characteristics of these configurations will initially be estimated using trade studies involving theoretical prediction techniques. Those found to be acceptable will be incorporated into a predesign analysis and tested in ground facilities to experimentally verify the aerodynamic characteristics. A prime consideration for all facets of this effort will be fuel economy in application to new designs as well as existing systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0053, AERODYNAMICS OF SUPERSONIC LIFTING BODIES

M.C. Jischke, University of Oklahoma, Norman Campus, School of Engineering, Dept. of Aerospace & Mech Engin, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (DF050200; AFOSR-77-3468)

AF function - this research contributes to missile aerodynamics R.O. 4.2 and conventional weapons R.O. 6.2. Deficiency - the ability to predict high supersonic flow past vehicle configurations of practical interest is quite limited. The available theoretical methods for analyzing supersonic lifting vehicles are not sufficient to support design and development of efficient low-drag, high-lift configuration. Objective - the purpose of this study is to overcome the limitation of existing theoretical methods to predict performance of vehicles at high supersonic flows. Contribution - this research offers the promise of developing theoretical methods and experimental results that will considerably strengthen current abilities to design vehicle configurations in the high supersonic range that are aerodynamically efficient and can meet demanding maneuverability requirements.

The research into the aerodynamics of supersonic lifting bodies consists of three phases: analytical, numerical and experimental studies. In the first year the analytical studies will develop approximate results for the inviscid flow past elliptical cones and near circular cones. The analytical results will then be used to develop waverider vehicles with integrated inlet designs. The analytical results should also prove valuable in determining how the aerodynamic performance of supersonic lifting bodies can be improved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0054, ANALYSIS OF CRITICAL MICROSCOPIC FLOW BEHAVIOR

J.L. Swedlow, Carnegie Mellon University, Inst. of Technology, Dept. of Mechanical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF051080; AFOSR-78-3533)

AF function - improve durability of aerospace vehicles. Opportunity - to merge the materials science qualitative description of microscale constituent interactions with the solid mechanics quantitative description of mid- and macroscale design parameters, via theoretical/ computational research. Objective - to continue development of understanding of strain localization, void nucleation, growth and coalescence and transition to macrofrac-

ture in a multiphase/multiconstituent material. How work contributes o by providing a fundamental join of two well-developed technologies, leading to improved understanding of the fundamentals of material/structure interaction, strength/toughness trade-offs and the failure initiation process.

The previously developed computer progran (ref afosr-76-2993) will be appropriately modified to allow investigation of alternate criteria for inclusion-matrix debonding in order to determine debond location and stress level. These results will be correlated with metallurgical literature to establish model validity. With the initiation process model established, void growth, interaction and coalescence will be studied, with bond the single inclusion and multiple inclusion models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0055, ROOM TEMPERATURE SUPERCONDUCTION IN ORGANIC SOLIDS AND BIOLOGICAL SYSTEMS

F.W. Cope, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881427)

To obtain experimental evidence for superconduction in organic solids of biological orgin and in living systems and in other organic solids. This may point the way to the development of room temperature plastic superconducting wire for major reductions of size and weight of naval electrical machinery of computers and of sensitive magnetodetectors.

Superconduction in organic solids at high temperatures was predicted over 20 years ago but experimental observation of this was delayed until five years ago when probable superconduction was demonstrated in the bile acids and a probable Josephson effect was seen in carbon films at room temperature. Evidence was obtained by Cope for superconduction in living systems. Experimental evidence of superconduction in solids of biological origin and in living systems and in other organic solids at temperatures as high as room temperature will be sought by new methods. This may provide information regarding choice of material for later fabrication of plastic wires which superconduct at room temperature which may make practical the construction of naval electrical machinery of much less size and weight because of the absence of heat generation in the superconducting wire. Superconducting computers magnetodetectors and microwave detectors may then also become practical because of the removal of the need for refrigeration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0056, CONTROL OF NONLINEAR SYSTEMS

A.E. Pearson, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF040420; AFOSR-75-2793)

AF function - design of control system for air-to-air missiles. Deficiency - missile performance in sea has demonstrated that air-to-air missiles have inadequate guidance systems. Objective - the objective of this research is to develop analytical methods for controlling nonlinear systems. How work contributes - success in developing such methods could enable the implementation of improved guidance schemes for air-to-air missiles.

Research will be conducted on four areas. First, development will continue on feedback control laws for a class of differential-delay linear systems with application of previous results to periodic time-varying systems. Second, minimum energy control will be tried for the approximated noncommutative bilinear system. Bounds on error in the response due to finite series approximation will be explored for the commutative bilinear system. Third, parameter identification will be directed to a class of quadratic systems represented by a vector differential operator equation. The filter adopted by the principal investigator will be developed for signal estimation, including the possible formulation of a minimum variance estimation when the unknown coefficients are defined as a random vector with known statistics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0057, SUPERSONIC JET MIXING

R.P. Rhodes, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421055; F40600-77-C-0003)

The ability to predict IR radiation emitted from low-altitude rocket plumes is of importance to AFFTD, AFRPL, and other DOD agencies. An accurate analytical model of plume fluid mechanics, afterburning, and radiation is required. A major unresolved question in the modeling of supersonic jet mixing with an external stream is the effect of density gradients resulting from compressibility as opposed to those caused by temperature or molecular weight difference. Cold jet experiments using the same apparatus as the rocket plume mixing tests would help resolve these and other questions and greatly broaden the data base for testing the validity of analytical models.

An experiment will be designed and conducted to measure the flow field properties of a cold jet discharging into subsonic and supersonic streams. Necessary hardware modifications will be designed and fabricated. Static and total pressure, temperature, and species concentrations will be measured at several axial stations in the flow field. The data will be reduced to radial profiles of velocity, jet species concentration, and total enthalpy and compared with various models of 'Mach number effect'. The validity of these models will be assessed to formulate a more correct model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0058, FLOW VISUALIZATION STUDY OF SECONDARY FLOW IN A CORNER

F.G. Collins, University of Tennessee, Central Office, Space Inst., *Tullahoma, Tennessee* 37388 (DF051520; AFOSR-78-3537)

AF function - advanced aerospace vehicles. Opportunity - to develop methods for modeling the interfering flow which occurs at the wing-fuselage juncture of an aircraft. Providing more accurate drag prediction, such a method would lead to the design of more aerodynamically efficient aircraft. Objective - to study by means of flow visualization in a water tunnel the secondary flow which occurs in a corner region. How work contributes - will increase the level of understanding of the fluid mechanics associated with flows in corners. In particular, will concentrate on the structure and properties of the corner vortices in laminar and transitional flow.

The flow in the sharp 90 degree corner formed by intersecting flat plates will be studied during a water tunnel test, primarily by means of flow visualization. Data for determining skin friction and velocity profiles in the flow field will be collected. The range of Reynolds numbers in the test will encompass laminar and transitional flows.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0059, DETERMINE LOADING BEHAVIOR OF MK7-1 AND MK7-2 ARRESTING GEAR

R.S. Ebers, L T V Aerospace Corp., Vought Systems Division, *P.O. Box 5907, Dallas, Texas* 75222 (DN590025; N00019-75-C-0237)

Perform a study to determine the characteristic loading behavior of the MK7-1 and MK7-2 arresting gear by analysis of airplane test data.

The approach will consist of data gathering and data analysis to establish optimum characteristics for loading behavior of the arresting gear.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0060, FLIGHT OPERATIONAL FIBER OPTIC DATA LINKS

L. Stewart, Spectronics Inc., *830 Arapaho Rd., Richardson, Texas* 75080 (DF110470; F33615-77-C-1226)

The objective of this effort is to demonstrate flightworthy and operational system compatibility aspects of wideband fiber optic point-to-point links. Recent experiments have shown that available fiber optic technology can be used to satisfy low data rate requirements within modern aircraft.

Two wideband fiber optic data links will be designed and installed on an RC135 A/C for performance evaluation during operational flight tests. The links will be designed to interconnect (1) the ARC-259-41A, OF processor and the QRC-259-51, PAN display (160 mHz bandwidth) and (2) two QRC245A(T)-1A-1 VIDIS video distribution units (20 mHz bandwidth). A final report will be prepared after flight tests are completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0061, A MICROPROCESSOR IMPLEMENTATION OF A NAVIGATION POSITIONING ALGORITHM FOR THE LOW-COST GPS RECEIVER

P.S. Noe, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engin, *P.O. Box F E 44, College Station, Texas* 77843 (DF049250; AFOSR-77-3377)

AF function - design of microprocessor algorithms. Deficiency -accurately timed signals, received from several orbital satellites for navigation purposes, are corrupted by various electronic noise sources, and require filtering to properly process them. Objective - it is the objective of this research program to develop a microprocessor implementation of an algorithm devised by the principal investigator (PI) under a USAF/ASEE summer faculty fellowship. How work contributes -if successful, this program would present a viable candidate for a low-cost on-board navigational receiver for casual installation in diverse aerospace vehicles.

A low-cost navigation positioning algorithm was previously developed by the proposed PI under Air Force support. This research will utilize IBM high level language programs to optimize the machine code for microcomputer application. Subsequently, the microbe will be implemented to demonstrate the effectiveness of microcomputer hardware as a feasible component of the GPS system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0062, STUDY FREE BALLOON DESIGN

J. Rand, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (DF246350; F19628-76-C-0082)

AF function - advanced balloon systems (surveillance, delivery operations, environmental research support, space equipment test). Deficiency - balloon design criteria are inadequate to take maximum advantage of improved material properties. Objective - develop criteria for advanced balloon designs using improved materials. How research contributes - the gross lift capability of balloons will be increased enabling improved capability (duration, altitude, payload and maneuverability) with enhanced reliability.

A load transfer model will be developed to accurately describe stress distributions under various flight conditions. This model will be integrated with a temperature and strain rate dependent biaxial yield stress design criteria into a computerized design procedure. The effects of using flat gores to develop three-dimensional surfaces will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0063, PROPULSION INDUCED AERODYNAMICS OF V/STOL IN TRANSITION/STO

T.D. Beatty, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN881372; N62269-78-C-0036)

Development of a methodology for prediction of propulsion induced aerodynamics of multi jet V/STOL aircraft in the transition/STO flight regime. This contract supports work unit ZA601, Agency Accession No. 681080.

Advanced development of computerized prediction technique for V/STOL aerodynamics will be accomplished. An improved vortex and entrainment jet flow model will be incorporated together with a method to account for jet wake separation. An image system for ground effect will be modified to permit calculations throughout the STO flight regime including the effects of jet impingement on the ground. Correlation of predictions with experimental data will be accomplished for representative V/STOL configurations.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0064, ADVANCED SYMBOLOGY GENERATOR (ASG)

D. Garner, Evans & Sutherland Comp. Corp., *3 Research Rd., Salt Lake City, Utah* 84112 (DF323190; F33615-77-C-0531)

To specify, configure, and fabricate a dynamic interactive computer graphics display system. This system will provide the capability for developing, generating, and displaying advanced symbology presentations in a laboratory environment on helmet-mounted displays which are a subsystem of the visually coupled airborne system simulator (VCASS) system.

The multiple requirements of the visually coupled airborne systems simulator (VCASS) involve the design, development and evaluation of a self-contained, ground/airborne, man-in-the-loop visual/display simulator. This simulator will be used to perform the man-machine interface design and engineering of cockpit control/display subsystems for advanced technology aircraft and for solving deficiencies in existing visual scene simulation techniques. To meet these requirements an advanced symbology generator becomes a critical subcomponent of VCASS. Key design goals include configuring the ASG system with the flexibility needed to allow the user to construct and iterate a wide range of symbology presentations to thoroughly test the VCS/scene dynamics interfaces and to design the appropriate interfaces between the ASG and helmet-mounted display (HMD) that will permit the ASG to utilize the maximum capability of the HMD. The program is divided into three phases. The first (design) phase will determine ASG system configuration and approach to the ASG/HMD interface design. The second (fabrication) phase will result in the building of the ASG as well as the final design and building of two separate HMD interface units. The third (engineering support) phase will provide maintenance support and consultation or system use and interface to other VCASS equipment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0065, LAMINAR SEPARATION AND FLOW INSTABILITIES

A.H. Nayfeh, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Mechanics, *Blacksburg, Virginia* 24061 (DN223402; N00014-75-C-0381)

The ability to predict and to control flow instabilities and separation is essential for the design and optimization of aircraft and missiles. The proposed research will study, theoretically, confined separation bubbles on compression ramps at supersonic speeds, and the generation of secondary instabilities in laminar boundary layers.

A study will be made of confined separation bubbles formed on compression ramps at supersonic speeds in an attempt to extend the range of validity of the classical triple-deck asymptotic model to lower Reynolds numbers. The analysis will be in a theoretical framework which extends the classical model to second order and concentrates on the case of non-adiabatic walls. The new results will be compared with the first order predictions and with predictions of interacting boundary layer theory to assess the breakdown of the triple deck concept as the Reynolds number is reduced. In addition, secondary instabilities in laminar boundary layers will be investigated. The Tollmien-Schlichting instability wave will be calculated for a Blasius flow and combined with the Blasius flow. The resulting combined flow will be linearly perturbed and the conditions for the initiation of secondary instabilities, both two- and three-dimensional, will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0066, APPLICATION OF SYNTHESIS TECHNIQUE FOR NON-LINEAR UNCERTAIN SYSTEMS TO FLIGHT CONTROL OF ADVANCED MISSILES

I. Horowitz, Weizmann Inst. of Science, *P.O. Box 26, Rehovot, Israel* (DA0D9381; DAERO 78 G0024)

The technical objective of the program is to use a new synthesis technique for solution of the problem of flight control of advanced missile system.

A new exact synthesis technique has been recently developed for synthesizing nonlinear time-varying feedback systems with uncertain parameters, to satisfy assigned performance specifications. Hitherto, approximate linearizations have been used for this purpose. Application of this new technique to the problem of flight control of an advanced missile system in which there is a very wide operating regime, both in altitude and Mach number, will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0067, ATMOSPHERIC ASPECTS OF EMPLOYMENT OF CO2 LASER

P. Browne, University of Manchester, Inst. of Science & Technology, *Sackville St. I Lancs, Manchester, England, United Kingdom* (DA0D9330; DAERO 78 G0126)

To determine the effects of atmospheric clouds, fogs, and mists on the propagation of coherent electromagnetic radiation with a wavelength of 10.4 microns, with special attention to linear attenuation and backscattering, non-linear attenuation and backscatter, and beam quality under both linear and non-linear propagation conditions for clouds produced in the laboratory by adiabatic expansion.

Greatly improved versions of a high-energy pulsed CO sub 2 laser, and a low-power continuous-emission CO sub 2 laser will be developed, so that they can be used both in the laboratory and the field. Laboratory experiments will be based on measuring transmission and scattering characteristics of the beams while propagating through water aerosol clouds generated by adiabatic expansion of saturated air in a chamber under controlled conditions. Field experiments will be conducted in natural water aerosols at Great Dun Fell. Close coordination will be maintained with the Atmospheric Sciencies Laboratory and with other Army laboratories.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ULF STUDIES AT THULE, GREENLAND

R.R. HEACOCK, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DPP7810539)

A digital fluxgate magnetometer and a fast response riometer will be installed and operated at Thule, Greenland. The data obtained will be used to investigate the coupling of pulsations in the interplanetary magnetic field with the magnetosphere, and to investigate the rate of interplanetary shocks and structure in producing hydromagnetic waves in the magnetosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0002, CONSTRUCTION/OPERATION EFFECTS

C.E. Payne, U.S. Dept. of Defense, Navy, Civil Engineering Lab., Naval Construction Battalion Center, *Port Hueneme, California* 93043 (DN887055)

To develop from scientific and engineering knowledge a technology base for maintaining and/or the restoration of natural resource quality.

An expert contractor will follow prescribed procedure to classify and inventory aquatic, terrestrial and wetland ecosystems and to inventory both physical and functional ecological parameters and species at site. Inventory will continue for four (4) seasons, will be closely monitored for performance, true cost/time required. The procedure will be reviewed, updated and modified to meet the Navy's needs and requirements. LANDSAT capability will be evaluated in terms of cost/effective application to this objective.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Facilities Engineering Command

5.0003, A STUDY OF LOW-ENERGY ELECTRONS OVER THE POLAR REGION BY USING THE USAF OPERATIONAL DMSP SATELLITES

K.A. Anderson, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DF044460; F49620-78-C-0035)

AF function - the accurate knowledge of the polar ionosphere in real time is vital in transpolar radio wave propagation. Deficiency - an effective method is required for the remote sensing of conditions in the polar ionosphere. Objective - by using data from the USAF DMSP satellites, the electron precipitation characteristics for different auroral activities and other types of low-energy electron precipitation are to be identified. Contribution - after completion of this work, it should be possible to infer global distributions of detailed auroral electron precipitation based on DMSP auroral photographs.

Analyses are to be made of the simultaneous auroral and electron data from a dawn-dusk orbiting DMSP 33 satellite and new DMSP Block 5D satellites. The DMSP data are to be used to determine the electron precipitation characteristics of morning oval auroras, during both quiet and disturbed periods, auroral arcs over the polar caps, and the dayside auroral oval particularly in the cusp region near the noon meridian. Coordinated multiple satellite and ground-based observations are to be made using the ATS-6 geosynchronous satellite, the Atmospheric Explorer satellites and the incoherent-scatter radar at Chatanika.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0004, SATELLITE MEASUREMENTS AND ANALYSIS OF THE RADIATION BUDGET OVER MONEX

T.H. VonderHaar, Colorado State University, School of Natural Sciences, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (ATM7820375)

The objective of this research is to gather, process and analyze satellite-derived radiation data in order to calculate radiation budgets for the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP). Observations will be used from the U.S. and Japanese geostationary satellites and the U.S. polar orbiting satellite the NIMBUS-G. These observations will be combined with MONEX aircraft and surface measurements.

The radiation budgets will be determined at the top of the atmosphere and at the earth's surface on time scales of 1 hour to 1 week and space scales of 5 km to 500 km. In addition, the time-dependent net atmospheric radiation budgets over disturbed monsoon cloud regimes will be examined and contrasted with those over the adjacent land and ocean areas.

MONEX is a major study to increase our understanding of the dynamics and thermodynamics of the atmosphere and ocean in the monsoon regions of the world. This research addresses the specific problem of the heat sources and sinks of the summer and winter monsoons. It is the first attempt on this scale of gaining a clearer understanding of the driving mechanism for the monsoon, the most energetic local wind system on earth.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0005, METEOROLOGICAL PHYSICS

B.R. Bean, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AC42001)

PROJECT OBJECTIVE: Conduct studies of the atmospheric boundary layer, its microstructure and turbulence, utilizing mainly airborne techniques.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0006, SEASAT

D.B. Ross, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8B326348)

PROJECT OBJECTIVE: To verify accuracy and precision of SEASAT satellite measurements of sea surface temperature, wind, and wave conditions, and utilize SEASAT derived geophysical measurements in developing a better understanding of interactions between the ocean and the atmosphere.

CURRENT YEAR PLAN: (1) To install and operate a real aperture imaging radar aboard NOAA aircraft. (2) Initiate modification of existing wave prediction models to be compatible with SEASAT inputs. (3) Continue research on the relationships between remotely sensed surface parameters and desired oceanographic measurables.

PROGRESS REPORT: A Navy APD-7 real aperture radar system has been installed on the NOAA RFC P3C for SEASAT underflights in hurricanes and winter storms. A new spectral wave model has been developed for the AOML Univac 1108. This model together with a parametric model developed in Germany and adjusted to the 1108 are being used to conduct application studies using SEASAT-A data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0007, GEOMAGNETIC MICROPULSATIONS

V.L. Patel, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM7821969)

This grant extends support for the continuation of a study of geomagnetic micropulsations in the magnetosphere and their propagation to the surface of the earth. The principal aim of the study is to utilize the existing satellite data on the magnetosphere in order to correlate the observed hydromagnetic wave phenomena with surface observations. Recent theoretical and observational research work has emphasized the importance of plasma density gradients in the generation mechanisms of the low-frequency hydromagnetic waves that appear as micropulsations in the geomagnetic surface observations.

The major objective during this extended time period will be to organize results which have already been obtained into power spectra and polarizations of selected wave events in the magnetospheric satellite observations near 5 to 6 earth radii and the surface geomagnetic field.

The end results of this work will be an increase in our understanding of the way in which magnetic disturbances are created and propagated in the near earth environment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0008, STUDY OF ATMOSPHERIC MECHANISMS

Unknown, Center for Environment & Man Inc., *275 Windsor St., Hartford, Connecticut* 06120 (FA77WA-4055; FA160410 (TRAIS NO.))

Perorm a study of Atomspheric Mechanisms and accomplish the following tasks: (1) Exhaust trail diffusion and chemistry; (2) Distribution of trace constituents; and (3) Meteorological considerations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0009, TESTS OF NEW SYSTEMS

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, National Meteorological Center, *5200 Auth Rd. S.E., Washington, District of Columbia* 20023

OBJECTIVE: Determination of effects upon NMC products of new data sources and analysis/forecast system changes.

STATUS: Data Systems Test and Optimum Interpolation Analysis System test completed.

PLANS FOR FY79: Assessment of data from new sources: a) TIROS-N and NOAA-A: The data from these major FGGE-related sources will be assessed for quality prior to introduction into NMC operations. b) Other FGGE related data: Japanese and European satellite winds, drifting buoys, ASDAR, AIDS, and Special Observing Period data will be assessed as appropriate. c) The FGGE Special Observing Period (SOP) Special Effort: A quality control editing and enhancement of the SOP data set, using advanced technology (McIDAS system). d) SEASAT: The quality of the remotely sensed seasurface winds will be assessed and development of proper ways to incorporate them into NMC analysis systems, with testing in forecast models, will be undertaken.

IMPACT OF DATA, NEW, AND OLD: a) The Tiros-N and NOAA-A data impact on analyses will be assessed by experimentation with the FINAL Cycle data assimilation system. b) The RIROS-N and NOAA-4 data impact on forecasts will be assessed by experimentation with NMC's operational forecast models. c) NESS operationally produced satellite winds' impact on analysis and forecasts will be tested. d) Impact of other FGGE data and SOP Special Effort enhanced data may be assessed as appropriate. e) The impact of aircraft integrated data systems (AIDS) high-resolution wind measurements upon commercial aviation flight plans will be determined.

NEW ANALYSIS AND FORECAST SYSTEMS: A) Preimplementation testing of an analysis system (either OI or isentropic) to replace the Cressman system for the regional (LFM) model will be undertaken. b) Similar testing may commence of an OI system to replace the Hough analysis for the hemispheric (7L PE) model. c) Tests of forecast models as potential replacements for current operational models. Possible candidates are: 1) HEMISPHERIC: 9-layer PE or Spectral vs current 7L PE. 2) FINAL CYCLE: Spectral vs current 9L GLO. 3) MEDIUM RANGE: Spectral or Global 6-layer (Vanderman model) vs current 3-layer global.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0010, METEOROLOGICAL PROCESSES (MARINE BOUNDARY LAYER PHYSICS)

W.A. Hoppel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN639119)

Provide new and improved capabilities to the Navy in its functions of predicting and modifying fog and rainfall. Achieve a better understanding of cloud and fog dynamics, glaciation, condensation processes, electrification, and the role of cloud condensation nuclei (CCN) in clouds and marine fog and their effects on naval operations and electrooptical systems.

Theoretical modeling, laboratory studies, and field experiments are used to determine the characteristics of natural and artificially modified clouds and fog, to identify promising areas of new research, and to develop physical principles for the design of new instruments, some of which are developed within 6.2 work units.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0011, SEA SPECTRA ANALYSIS TECHNIQUES FOR TARGET SURVEILLANCE AND ENVIRONMENTAL SUPPORT TECHNIQUES FOR WAVEHEIGHT MEASUREMENT

D. Stilwell, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680027)

The objective of this program is to further analyze the remote sensing capabilities of the sea photo analysis technique. The technique is being researched to a degree where it may be used routinely to sense and measure the state of the ocean surface spectral fluctuations under a wide range of conditions. Success in this effort will result in a new naval method for the determination

of major ocean descriptors, which can have a decided impact on naval sensors and systems; e.g., the detection of small targets on the ocean and sensing area extensive but small perturbations of ocean surface features.

Sea photo analysis techniques are being applied in the areas of target detection and real-time sea state determinations. The present limitations of sea photo analysis, viz. high obliquity, perspective distortion, long wavelength suppression, and wave sensitivity inaccuracies will be studied and means for alleviating them investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0012, GRAVITY FIELD IMPROVEMENTS

G. Blaha, Nova University, Fort Lauderdale Campus, Graduate School, *College Ave., Fort Lauderdale, Florida* 33314 (DF580150; F19628-78-C-0013)

AF function - weapon systems navigation, guidance and delivery. Deficiency - launch site, target position and geoid uncertainties degrade accuracy of weapon delivery. Objective - ability to use most up-to-date computational developments for gravity field determinations. How research contributes - contractor will study computation methods for gravity from satellite altimetry.

A multi-branched study of computational methods will be directed toward use of the most up-to-date techniques for gravity field determinations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, THE FORMATION AND DISTRIBUTION OF WHITECAPS PRODUCED BY BREAKING WAVES ON THE OCEAN SURFACE

R.L. Snyder, Nova University, Ocean Sciences Center, Physical Oceanographic Lab., Dept. of Oceanography, *8000 N. Ocean Dr., Dania, Florida* 33004 (OCE7610739A02)

This project will study the formation and properties of whitecaps (foam) produced by the spontaneous breaking of surface waves. Photographs of the formation and growth of whitecaps have been collected for a variety of wind conditions at an instrumented tripod in the Bight of Abaco near Grand Bahama Island. The photographs will be scanned to determine the size, growth, and frequency of occurrence of the whitecaps. These properties will then be related to wind speed and direction and wave speed and direction. Attempts will be made to determine the criteria governing the formation of whitecaps. Understanding whitecapping is very important (a) to understanding energy dissipation by the breaking of surface waves, and (b) to interpreting data from remote sensing instruments mounted on aircraft or satellites. For example, instruments employing microwave-scattering techniques are very sensitive to the percentage of the sea surface containing foam. This project will give the desired high priority to analyzing the whitecap data.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0014, NAVY ENVIRONMENT - THE INFLUENCE OF CONVECTING FLOWS IN THE OCEAN AND ATMOSPHERE

R.E. Krishnamurti, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Oceanography, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DN323080; N00014-75-C-0877)

Convective circulation observed in all fluids undergo transitions through several well-defined regimes, leading eventually to turbulence. Flows of this nature occur in the ocean and atmosphere influencing energy balance in wind-wave interaction, turbulence generation, in subsurface thermocline inversions, and cloud pattern formation as observed by satellite. Each of these fluid dynamic phenomena must be understood for predicting the physical characteristics of ambient environments within which the Navy must operate.

Professor Krishnamurti will conduct an investigation of boundary effects on transitional convective flows and the interaction of them with superposed mean flows. Included will be studies of wind-wave interaction and surface temperature gradients which lead to convective instabilities in ocean circulation models. Stability and transition to turbulence of some flows will be examined, and the convective effects upon biological maintenance of some species will be completed. The latter study may have implication for some ASW signatures which still remain an enigma.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0015, SURVEILLANCE - INVESTIGATION OF PROPERTIES OF RADAR BACKSCATTER FROM SEA ICE

R.K. Moore, University of Kansas, Lawrence Campus, Center for Research Inc., *122 Strong Hall, Lawrence, Kansas* 66045 (DN775037; N00014-76-C-1105)

The objective of this effort is to provide backscatter properties of sea-ice to permit better interpretations to be made of the sea ice imagery taken during overflights of the arctic with remote sensors; and to establish optimum parameters for future remote ice-measuring systems.

A transportable radar scatterometer is to be assembled capable of variable frequency operation in the 12-18 gHz band and fixed frequency operation at 1.2 gHz. Using this equipment from a helicopter platform and varying the frequency, polarization, and angle of incidence, radar backscatter measurements of arctic sea ice (first year ice, multi-year ice and pressure ridges) are to be made. In a separate experiment these measurements are to be made in conjunction with SEASAT-A overflights in the Beaufort Sea area of the arctic basin. The results are to be analyzed and the optimum design parameters for radars to be employed for remote sea-ice monitoring from spacecraft or aircraft are to be generated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0016, NAVY ENVIRONMENT - MEETING ON SATELLITE OCEANOGRAPHY

K.C. Spengler, American Meteorological Society, *45 Beacon St., Boston, Massachusetts* 02108 (DN875327; N00014-78-G-0042)

The objective of this meeting is to promulgate the new advances in satellite data processing and spacecraft sensors which have oceanographic applications. From the meeting specific research applications relating to naval problems in the description and prediction of the ocean environment will be defined.

The effort will accomplished by a series of presentations by selected leaders in satellite technology and by invited recognized scientists applying satellite technology to basic research on the oceans. It is planned that one or more of the presentations will be submitted for publication in the Journal of Physical Oceanography.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0017, DISPLACEMENT TECHNIQUES IN SHORT-RANGE FORECASTS OF SURFACE WEATHER USING SATELLITE INFORMATION

S.H. Muench, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581510)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military support requirements. Objective - to evaluate displacement techniques in making short-range local forecasts for periods of one to six hours of surface weather conditions using geosynchronous satellite information. How development contributes - the products of this work unit will enable Air Weather Service to choose an optimum satellite-based forecast technique to satisfy forecast requirements and reduce manpower.

Satellite data for approximately 10 weather episodes will be collected, including storm systems of varying size and intensity. Techniques currently used to determine motion vectors from digital data will be adapted to the satellite data format, and a series of tests will be run to determine their relative accuracy in forecasting changes in cloud parameters. The use of wind infor-

mation from NWP products will also be tested as a motion vector technique. A procedure will then be developed to forecast probability of cloud cover and precipitation using the best motion vector technique along with algorithms developed in IHWU 66700802. A series of test forecasts will be made and the accuracy of results compared to those based on persistence and on Markov-type techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, ELECTRON HEATING OF THE MID AND AURORAL LATITUDE IONOSPHERE

M. Kanal, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248690; F19628-78-C-0074)

AF function - communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of heating mechanisms and their effects on topside scale heights for needs of AF systems. Objective - to calculate the heating rate of mid latitude ionosphere as a result of bombardment by energetic photoelectrons from the conjugate ionosphere. A similar study of effects of high-energy auroral bombardment will also be undertaken. Results will be compared to in-hand data from AF satellite experiments. How research contributes -provides information essential to microwave and radio frequency transmission through auroral and mid latitude topside ionosphere, provides data essential for design and utilization of communication guidance and surveillance systems, provides understanding of auroral and mid-latitude ionospheric transport mechanism.

Apply existing computer codes to analyze and synthesize AF satellite data in auroral and mid latitude topside ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, STUDIES OF WAVE-CURRENT INTERACTIONS

M.Y. Su, U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity, Naval Oceanographic Lab., *Bay St. Louis, Mississippi* 39529 (DN894404)

The initial objective is to collect and analyze experimental measurements of the effects of steady, non-uniform currents on the spectra of progessive wave trains in an outdoor simulation facility. These results will form (1) the basis for the evaluation of existing theoretical wave-current interaction mechanisms, and (2) the semi-empirical foundation for satellite data interpretation techniques applied to the detection of ocean fronts and eddies. Ultimately, the results of this work could lead to the reformulation of global wind-wave forecasting models.

Using the large, controlled flow channel at MSTL, steady non-uniform water currents will be generated. Surface gravity waves of variable amplitudes and frequencies will be generated by a plunger-type mechanical wave maker. These waves will be directed in upstream, downstream, and slant directions with repect to the current axis. Effects of eddies on wave spectra will be simulated near the right-angle bend of the channel. Time series of current speeds and wave heights at various locations along and across the channel will be measured simultaneously. Wave frequency spectra will then be computed from these time series. The effects of currents on wave height, frequency and refraction will be characterized by comparisons of wave spectra produced.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0020, AREAL DIFFERENTIATION

J.H. Stine, Oklahoma State University, School of Arts & Sciences, Dept. of Geography, *Agricultural Hall, Stillwater, Oklahoma* 74075

Alternative sequences for the theoretical investigation of direction and magnitude of change in areal differentiation, location, and spatial interaction systems.

SUPPORTED BY Oklahoma State Government

5.0021, ACQUISITION OF OCEANOGRAPHIC EQUIPMENT

J.J. Griffin, University of Rhode Island, Graduate School of Oceanography, Dept. of Oceanography, *Administration Bldg., Kingston, Rhode Island* 02881 (OCE7823744)

This award will provide improved facilities and scientific equipment aboard the research vessel Endeavor, operated by the University of Rhode Island's Graduate School of Oceanography. The facility improvements consist of oceanographic cable and telecopiers for a satellite communication system. The scientific equipment will consist of thermometers and an instrument for sea water analysis.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0022, MAGNETOSPHERIC CURRENT SYSTEMS AND RESULTANT MAGNETIC VARIATIONS

A.J. Dessler, Rice University, Graduate School, Dept. of Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (DF248260; F19628-77-C-0005)

AF function - operation of systems for communications, detection, surveillance, guidance, and navigation. Deficiency - system performance is degraded during severe geomagnetic disturbances that produce extreme departures from the normal conditions in the propagation environment. Objective - investigate methods for real-time predictions of changes in the magnetosphere-ionosphere system and determine how to infer the state of the magnetosphere with data from the magnetometer network and other data that will be continuously available. How research contributes -development of methods for prediction of changes in the magnetosphere-ionosphere system will permit accurate and reliable forecasts of geomagnetic activity. Such forecasts will enable system operators to take appropriate measures to lessen the impact of disturbances on military operational capability.

The program will involve detailed computer simulation of selected observed events in the inner magnetosphere, particularly magnetospheric substorms and the main phases of magnetic storms. Additionally, a comparison will be made between magnetic signatures recorded by the AF Geophysics Laboratory magnetometer network and those generated in the computer simulation - signatures useful for predicting substorm timing and intensity. The computer simulation will provide a quantitative three-dimensional picture of the configuration of the inner magnetosphere during an event. Electric current distribution in the magnetosphere-ionosphere system will be computed as a function of time permitting the determination of corresponding surface magnetic-field perturbations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, SATELLITE SENSING AND RADIATIVE TRANSFER

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF051900; AFOSR-78-3576)

AF function - remote sensing of atmospheric properties from satellites is the only feasible method of acquiring the worldwide coverage necessary for prediction model initialization, target weather identification, data collection for support to E/O surveillance systems and the development of climatologies. Deficiency - clouds and precipitation adversely effect microwave remote temperature sensing measurements. The effect of clouds on solar heating of the atmosphere and rainfall rates can possibly be extracted from the temperature data. Objective - to understand the effect of atmosphere moisture on microwave soundings of the atmosphere and test the thesis that information as rainfall rate can be obtained from the microwave measurement. Contribution - several microwave sounders are currently aboard NOAA and DOD meteorological satellites. This research will enhance the information obtained by these instruments.

The effects of clouds and precipitation on NIMBUS and DMSP microwave sensors data will be analyzed. Attempts will be made to jointly use the IR and microwave data to enhance the

microwave measurements. Radiative transfer for the microwave channels in the presence of hydrometeors will be developed and the effects of cirrus clouds on solar heating investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0024, REMOTE SOUNDING IN CLOUDS

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581650; F19628-78-C-0144)

AF function - weather forecasting, weapons delivery, surveillance. Deficiency - inability to determine meteorological temperature profiles under cloudy conditions. Objective - demonstrate enhancement of satellite sensed temperature profiles arising from microwave sounder in a cloudy atmosphere. How research develops - improves the ability to infer and forecast temperature profiles from satellite observations.

Calculation of radiative transfer of infrared and microwave energy through cloudy/precipitating atmospheres will be used as a data base to infer temperature profiles for realistic atmospheric conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, PHASE AND AMPLITUDE SCINTILLATION AT THE EQUATOR

J.R. Koster, University of Ghana, *P.O. Box 4236, Accra, Ghana* (DF582150; AFOSR-78-3516)

AF function - communications, radar. Deficiency - signal fading increases error rates in communications, radar range errors. Objective - to predict effects of the equatorial ionosphere and signals transmitted by satellites. How research contributes - predicts and minimizes ionospheric related outages. This work continues observations in Ghana of suitable satellite signals and enables scientific analyses which integrate various geophysical parameters and searches for causative relationships.

VHF and UHF signals from ATS, GOES and MARISAT spacecraft will be continuously recorded. TEC and scintillation parameters will be computed and related to elevation angle effects. Measurements will continue on 136 mHz scintillation, as well as 257 mHz, and any higher frequency beacons that may become available. The possibility of microwave measurements is being considered. Faraday measurements will continue as long as a suitable satellite is available. GOES 1 was used until April, when its beacon was switched off. ATS-5 is currently being used, and GOES 2 is also a possibility should ATS-5 move or be switched off. The present rather extensive data will be used to complete a study of the equatorial evening minimum (EEM), and to continue the study of the dependence of scintillation on elevation, frequency and longtitude. This work supports GOSCS/SSS and GPS/NAVSTAR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ACQUISITION OF FLYING SKILLS

G.B. Reid, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223280)

To investigate the relationships which exist in pilot training between stage of training, training task structure, and feedback of information.

Simulation devices will be used to investigate training variables in order to develop a model of flying skill acquisition. Studies will be conducted to investigate such things as length of training sorties, fidelity of training task related to criterion task, subject experience and interaction with aircraft sorties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, SIMULATOR TRAINING REQUIREMENTS AND EFFECTIVENESS STUDY, PHASE TWO - DATA COLLECTION, ANALYSIS, AND FINDINGS

D. Nicklas, Canyon Research Group Inc., *32107 Lindero Canyon Rd., Suite 123, Thousands Oaks, California* 91361 (DF228410; F33615-77-C-0067)

To collect and analyze information bearing upon the cost and effectiveness of important characteristics of flight simulators. Such information shall be used to assist in determining the simulation required to meet each specific behavioral requirement for training, indicating the most effective techniques for using aircrew training devices, and specifying maximally effective instructional features of such devices. This is the second of five related work units for the Simulator Training Requirements and Effectiveness Study (STRES). This work unit will produce systematic information which will be further reviewed and consolidated in the final (fifth) work unit. It also will indicate critically needed studies which will be conducted under a fourth work unit to be documented under Project 1123. The third work unit also will be documented under Project 1123. It will assure coordination with related programs of the Flying Training Division (AFHRL/FT).

This work unit involves 5 sequential, but interrelated steps: (1) analyze all available relevant reports and systematize the resultant information pertinent to the cost and effectiveness of important characteristics of flight simulators, (2) prepare plans for Step 3, (3) collect, analyze, and systematize relevant information obtained from on-site surveys and interviews, (4) prepare special summary reports of the information obtained, and (5) plan critically needed experimental studies. The Tri-Service Management Team will maintain surveillance over these steps. Milestones for steps are- (1) July-August 77, (2) August-November 77, (3) October 77-January 78, (4) March 78-September 79, (5) March 78-April 19.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, PROTOTYPE HYDRAZINES ELECTROCHEMICAL ANALYZER

M. Shaw, Interscan Corp., *9614 Cozycroft Ave., Chatsworth, California* 91311 (DF323880; F33615-78-C-0607)

Survey monitors need to measure trace concentrations of the hydrazine rocket fuels in air to detect use area leaks and to protect personnel. Presently, available monitors lack portability, reliability and/or sensitivity. The state-of-the-art in electrochemical analyzers is now sufficiently advanced to provide the sensitive monitors needed at low cost. A portable hydrazine electrochemical analyzer shall be designed and built by the contractor.

The contractor shall design and build a portable hydrazine electrochemical cell that will provide sensitivity to better than 0.1 PPMV hydrazine, MMH and UDMH. Specificity will be maximized by selection of electrolyte, electrode system, composition, and potential and by air-electrolyte diffusion barrier membranes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0004, PHYSIOLOGICAL PERFORMANCE RELATED TO MULTIPLE STRESSES SUCH AS THOSE EXPERIENCED IN AIR FORCE OPERATIONS

S.M. Horvath, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Ergonomics & Physical Education, *Santa Barbara, California* 93106 (DF025960; AFOSR-78-3534)

AF function - the operation of AF weapon systems imposes on crew members combined stresses from extremes in temperature, pressure, acceleration, discomfort and fatigue from protective clothing and equipment, and prolonged missions with altered work/rest cycles. Deficiency - biomedical technology to improve present operations and to provide design criteria for future systems is critically dependent upon advances in knowledge about the physiological effects and performance decrements and predictions of operators exposed to these combined stresses. Objec-

tive - these studies are primarily concerned with the biochemical and endocrine interrelationships to stresses utilizing new radioimmunosssay procedures and other non-invasive techniques. An additional aspect of the current program will consider the responses and adjustments of females to altitude especially as addresses aerobic work capacity. How research contributes - results from these studies are in direct support of subarea 1.6, 'Habitable Crew Environments in Air Force Operations.'

A multidisciplinary group will investigate problems in human physiology as affected by combinative stresses particularly as these impinge on vigilance and exercise tolerance in males and females. Emphasis will be on immunochemical procedures and non-invasive techniques as a means of quantifying these effects. In view of the increased participation of females in the Air Force, adequate information as to their capabilities and limitations under varying stressful conditions will be pursued. The basic approach will be to compare female maximal and submaximal work capacity at altitude as compared to their male counterparts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, DYNAMICS OF AIRCRAFT ACCIDENT VICTIMS - COMPUTER SIMULATION

J.M. Ballo, U.S. Dept. of Defense, Armed Forces Inst. of Pathology, *c/o Walter Reed Medical Ctr., Washington, District of Columbia* 20306 (DA0B6608)

Computer simulation of the kinematics of occupants in selected aircraft accidents in order to recreate the sequences of injuries and to determine their specific cause(s). This will lead to an increased understanding of the pathogenesis of such injuries and lead to more effective means of preventing them. Examine feasibility of running concurrently the KRASH vehicle impact simulation code so as to enhance the realism of occupant-vehicle interaction.

Operate the CALSPAN three-dimensional program as a model using selected aero-space pathology division cases as sources of input data. Correlate the actual injuries observed at autopsy with the injuries predicted from the occupant kinematics of the computer simulation. Use the optimal output features of the CALSPAN code, using subroutines to calculate injury severity indices and time points of maximum injury.

SUPPORTED BY U.S. Dept. of Defense, Army, Medical Research & Development Command

6.0006, INCIDENCE AND COSTS OF AIRSICKNESS IN NAVAL AVIATION

W.C. Hixson, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Biological Sciences Dept., *Pensacola, Florida* 32508 (DN777278)

The ultimate aim of this project is to reduce the incidence and cost of airsickness in naval aviation. A preliminary study of NFO trainees suggested that airsickness may account for a larger proportion of student NFO attritions than was previously suspected. Additional costs accrue from repeated hops, evaluation and treatment programs, and increased time to train. Specific incidence and costs data obtained in this project can be used with increases in available information on various remedial actions to select and facilitate implementation of those remedial actions that prove to be cost-effective.

A longitudinal study of airsickness in NFO trainees as they pass through VT-10 basic training to VT-86 and other pipelines is underway. Airsickness incidence and performance data will be obtained on each student for each hop throughout training. Airsickness incidence will be related to particular hops, individual order of hops received, delays in training, performance, pipeline selection, attrition, and biographical data.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, CARDIOVASCULAR, RENAL AND RESPIRATORY EFFECTS OF HIGH INTENSITY INTERMEDIATE DURATION, LOW FREQUENCY VIBRATION

R.M. Nerem, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronaut Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF049720; AFOSR-77-3411)

AF function - AF operational personnel are subjected to a number of environmental stresses, one of which is vibration. With increasing number of missions in high-performance aircraft at low altitudes, crew members will be exposed to significant levels and durations of low frequency vibrations. Deficiency - the circulatory system is one of the mammalian systems most affected by vibration - of particular interest is the influence of vibration on the transport of certain blood elements to and across the vessel walls and the effects on renal function. For example, if cholesterol transport to the arterial wall is enhanced and/or if renal function is impaired this would have significant implications on long-term health problems of exposed personnel. Objective - three major objectives have been identified - (1) Continued development of the television-computer scanning technique will be carried out with the hope of having an extremely accurate and reproducible technique available within the first six months of the proposed project. (2) The basic mechanism of transport of material into the arterial wall under conditions of acute wholebody vibration will be studied. (3) On the basis of the acute experiments, an optimized chronic study of the effect of low frequency wholebody vibration on the deposit of cholesterol in the aorta will be carried out. How research contributes - this research supports objectives identified in AFSC RO 1.8, 'Aircrew Safety and Effectiveness in Mechanical Force Environments' and RO 1.5, 'Aerospace Medicine'.

The pulsed ultrasonic Doppler will be employed to study the effect of chronic whole body vibration on the arterial wall, a television-computer scanning technique will quantify atherosclerotic lesions resulting from whole body vibration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, EFFECTS OF AF PROPELLANTS AND CHEMICALS ON METABOLIC MECHANISMS

M.E. George, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320700)

The purpose of this basic research is to identify and define those underlying physiological and biochemical mechanisms associated with the systemic toxicity of chemicals and material.

Studies on the effects of toxic, carcinogenic and mutagenic chemicals of special Air Force interest and application on metabolic pathways and mechanisms of action require use of radioactive tracers, gas and liquid chromatography coupled with mass spectrometry, and electron microscopic evaluation of cellular and subcellular changes. The ultimate application of these fundamental mechanisms is to facilitate extrapolation of animal data to humans by selecting the most appropriate laboratory animal species which handles the compound similar to the metablic pathways of man.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, MECHANICS OF HYPEREXTENSION INJURY IN THE THORACIC SPINE

L.E. Kazarian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324200)

To identify the biomechanical conditions responsible for hyperextension injuries of the thoracic spine in the chimpanzee. This will examine the role of the powered 'haul back' system on shoulder and thoracic chest dynamics. These data will provide some insight into the mode and severity of spinal injury, shoulder and rib cage dynamics with respect to normal kinematics, and define the relationships between haulback angle and shoulder position to minimize upper thoracic chest injury potential. The information from this study will be used to develop new design criteria and protective measures for modifying current opera-

tional support and restraint systems and to provide design limits for future aerospace ejection systems.

Chimpanzees will be anesthetized, placed within current and modified support and restraint systems, and hauled back by powered retraction. High speed motion pictures will be taken simultaneously with the retraction. Acute and chronic injury modes will be identified later. the biomechanical parameters relating to spinal and thoracic chest trauma will be correlated to sitting height, shoulder height, retraction angle, shoulder kinetics, and pathology. The biomechanical factors responsible for perpetrating injuries will be delineated. These data will be utilized to develop a three-dimensional geometric and material property and kinesiologic model of the upper thoracic chest dynamics with respect to the angle of powered retraction for the chimpanzee.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, ADVANCED COMPONENT TECHNOLOGY

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321170)

This work unit will develop operator-centered display technology for AF real-time reconnaissance and weapon delivery functions. Display concepts will be formulated and prototype equipment developed to enhance man's visual ability to interface with various state-of-the-art and advanced development reconnaissance weapon delivery, teleoperator and simulation subsystems. These concepts involve visually coupled control/display devices (helmet-mounted sight/display), virtual image display techniques and holographic lens projection techniques. Consultation will be provided for further design, development, and deployment of systems based on these concepts. Efforts are coordinated with Tri-Service Display Technology Panel Members, the Naval Air Systems Command, Naval Air Development Center, Army Night Vision Laboratory, Air Force Armament Laboratory, Aeronautical Systems Division, and the Air Force Office of Scientific Research. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, PMDR P2033(5)/64708F/5973, Visual Coupling Aids, and TAC ROC 313-74, Skewable Electroptical Reconnaissance Sensor.

Promising state-of-the-art technology in optics, electroptics and electronics will be applied to develop and evolve operator display subsystems and concepts which enhance overall operator performance in target acquisition and weapon delivery tasks. During FY 77, design criteria and specifications will be defined for the interim and advanced helmet display components for the visually-coupled airborne systems simulator (vcass). Solid state matrix-element image sensing and generating devices will be integrated with new techniques, including holographic diffraction optics, to project images to the operator's visual field. Development of variable resolution and color virtual image displays will be continued. Pseudo-stereo effects and image multiplexing will be demonstrated and their effects on target acquisition defined in the display/image metric laboratory. Variable transmission visor techniques will be addressed. Display techniques for multisensor information (forward looking infrared, low light level TV, radar and laser sensors) will be evolved. This work unit, in part, encompasses work previously reported under work unit 7184-04-42, Display Concept Development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, BASIC VISUAL PERCEPTUAL PROCESSES FOR DISPLAYS

W.L. Martin, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322970)

To develop basic laboratory data concerning the detection and identification properties of the human visual system for simple (sinusoidal waveforms) and complex (military targets) objects. To determine the threshold and suprathreshold spatial/temporal filtering properties of the human observer in the fovea and parafovea. To investigate the possibility of improving normal and abnormal vision. To evaluate advanced concepts for operator visual interfacing and quantifying information transfer.

Studies will be conducted using facilities already constructed, the Maxwellian view system (MVS), to investigate human contrast sensitivity for information presented on chromatic displays. The MVS provides precise spectral and luminance control over sinusoidal waveforms for contrast sensitivity studies. Efforts will also include the creation of a Visual Psychophysics Laboratory (VPL). The VPL will, in addition to the MVS, incorporate a high-resolution cathode ray tube (HRCRT) display system to generate simple and complex sinusoid waveforms for the measurement of large field, foveal and parafoveal contrast sensitivity and contrast matching in any orientation. The VPL will also contain a custom made variable contrast device (VCD). The VCD will allow the control of contrast of any object on a 35 mm slide to determine HRCRT, and VCD will also be used to develop methodologies for possible improvements to normal and abnormal vision. The data collected from these devices will be used to create digital spatial filters that will be used to filter complex objects for basic research and validation studies. The conceptual framework for this research is a multichannel model of the human visual system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, TECHNOLOGY APPLICATION TO OPERATIONAL NOISE PROBLEMS

C.W. Nixon, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321390)

Air Force regulation 161-35 on hazardous noise exposure, which sets forth the AF noise abatement program, assigns responsibility to the Biological Acoustics Branch to provide consultation and technical assistance on personnel safety and effectiveness problems that are beyond the capabilities of the base. The objective is to provide consultation and apply the current technology base to the wide range of acoustic problems found in AF activities.

The approach is to conduct laboratory and/or field evaluations of specific problems or items of equipment to define the threat potential to health and performance capability and propose satisfactory solutions that comply with AF policies. Individual efforts are usually short term and include technical questions relating to sonic boom, noise exposure limits, ultrasound, infrasound, impulsive noise, communication equipment and hearing protection. Specific efforts include problems such as flight helmet effectiveness, communication with a fire fighter's helmet and with a new oxygen mask microphone in noise. Requests originate from all levels of AF and other governmental agencies and specifically include base flight surgeons, bio-environmental engineers, systems development offices and the life support SPO.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, HUMAN ENGINEERING SUPPORT GO GBU-15

J.M. Ring, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321010)

The GBU-15 (V)/B modular guided weapon system is a family of weapons comprised of two distinctly different aerodynamic configurations, different guidance systems, autopilots, warheads, fuzes, and an optical data link. There are more than 28 different configurations involved, with the Air Force procuring the modules and assembling them according to the theatre commander's assessment of the demands of the operational situation. The main objective of this effort is to provide human engineering support to ensure that blue-suiters can assemble the weapons in any of the required configurations, test and checkout the resulting configurations, upload, operationally use the weapon, download if necessary, and maintain the modules. The entire program is scheduled through FY 82. ADTC/SD15 is providing travel funds for the AMRL human engineering team and contractual funds for an on-site human engineer under the monitorship of the AMRL team.

The effort is paced by the schedule and directives pertinent to the GBU-15 (V)/B system and the development of major modules and components which comprise the system. The ap-

proach is to review appropriate specifications, drawings, and hardware (where available) to ascertain that the operational user can efficiently and effectively build up, test and check, and operationally employ the weapon. Program reviews and design reviews are attended and comments and suggestions made for more efficient and effective human use. Consultation with any or all of the 10 or more contractors involved, with appropriate ADTC, TAC, SAC, AFLC, AFTEC, ASD and ATC cognizant personnel is a continuing requirement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, BIOMECHANICS FOR COCKPIT DESIGN

S.M. Evans, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF317180; F33615-77-C-0505)

To improve USAF's capability to provide human engineering support to the design and evaluation of crewstations by automating the complex operator/machine interaction by means of a three-dimensional interactive graphics computer model. To automate the handling of body-size variability data to improve the utility of these data to guide the design of AF systems and equipment. To provide computer techniques for evaluating the effects of flight clothing on operator's interaction with the crewstation. To provide computer methods for sizing and design of personal-protective equipment.

The utility of the COMBIMAN (computerized biomechanical man-model) will be enhanced by the expansion of data bases for clothing/personal-protective equipment and aircraft cockpits. Techniques for automated reach-task analysis will be improved. A technique for the elimination of hidden lines on the display will be developed. AMRL's force testing devices will be used to obtain male and female strength data for the design and placement of aircraft controls.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, CRITERIA DETERMINATION OF THE ADVERSE EFFECTS OF LIGHT ADAPTATION IN THE NAVAL AVIATOR

G.T. Chisum, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN133013)

To develop the requirements for protection of the human visual system against adverse light adaptation situations which occur in combat conditions and in the use of devices such as novel eye position sensing systems and low light level viewing and display devices which are both operational and are being designed for use by naval aviators. The requirement for work in this area is established by naval research codes PA-10, LS4 and LS5 of the FY 1974 Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report.

Electroretinograms will be recorded from human observers following exposure to adapting light stimuli. Conditions to be varied are the level of light adaptation, the intensity of the adapting stimulus, and the duration and chromatic composition of the adapting stimulus. Of special interest will be the effects of eye position sensing pulses (including laser pulses) such as are used with some head-coupled weapon control and guidance systems and chromatic adaptation of the type encountered in the use of low light level viewing and display systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research Inst.

6.0016, HYDROXYLATED CONJUGATED AND EXCITED STATE DERIVATIVES OF CELLULAR METABOLITES IN BODY FLUIDS AS STRESS INDICATORS

H.W. Shmukler, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN333005)

To determine unique derivatives of cellular metabolites and bioregulatory factors like o-hydroxy hippuric acid in the urine of humans exposed to stressful aerospace environments. The goal is to achieve predictive indices of stress intolerance which will reveal the exhaustion of adaptive mechanism and the onset of pathology.

Thin layer and high pressure liquid chromatography will be used in conjunction with E.S.R. and fluorescence spectrophotometry to detect and quantitate the organic solvent soluble components extractable from the acidified urine of control and stressed military flight personnel. Results will be correlated with other stress indicators like blood phospholipids to achieve a biochemical indication of stress pathology.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0017, NUCLEAR SURVIVABILITY OF AIRCREW - LOW DOSE EXPOSURES

D.J. Barnes, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323360)

The objective of this project is to obtain accurate and reliable data reflecting the impact of nuclear radiation upon the performance capability of highly trained infrahuman primates. These primates are to be performing tasks analogous to those of a pilot of a modern strategic bomber and in an environment closely approximating that of an operational mission. From such an experiment radiation-impacted performance changes can be used to estimate pilot performance capability during operational missions. Such data would be useful to system survivability/vulnerability analysts and to operational planners.

Six infrahuman primates (rhesus monkeys) are to be trained to operate the primate equilibrium platform supplemented by the multiple alternative reaction task over a ten-hour period. After stable performance on these tasks are realized, a minimum of six pre-exposure baselines will be run to obtain normal performance standards. Exposure and post-exposure performance data will then be taken and compared with the normal performance standard to identify performance impacts and their magnitudes. Emetric responses shall be monitored visually and documented. The results will be documented in a technical report and made available to potential users.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0018, BIOCHEMICAL LONG-TERM RISK FUNCTION EVALUATION

D.A. Clark, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321890)

Determine whether selected biochemical factors (HDL cholesterol, LCAT activity, and phospholipid fatty acid composition) are significantly associated with coronary artery disease as diagnosed by angiography.

Measure levels of the biochemical indicators in patients before heart catheterization and correlate the levels with the findings of the catheterization studies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, EEG REPOSITORY

A.C. Gigliotti, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322060)

The objective is to develop long period EEG recordings and automated analysis capability in order to refine the definition of normal/abnormal status and apply these data to flying personnel on a short- and long-term basis. New methods and material will be developed to enable accurate identification of flyers with various neurological conditions which pose a hazard to flying safety or efficiency.

The approach is to obtain routinely an EEG on all subjects undergoing full evaluation by the Aeromedical Consultation Service and microfiche each recording for permanent storage. Individuals receive stimulation/provocation with hyperventilation and photic stimulation and if any abnormalities are noted, a sleep-deprived EEG is obtained. Interpretations are made in ac-

cordance with the Mayo Clinic system. Records that are interpreted as abnormal are retained, normal recordings are microfiched and destroyed. EEG abnormalities noted in the aircrew population and a matter of record in the EEG repository will be evaluated for true risk of occurrence of definite neurological sequelae over time. This effort was previously documented under work unit 7755-04-08.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, G-RELATED PATHOLOGY IN AF PERSONNEL EXPOSED TO HIGH-G STRESS

K.K. Gillingham, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319710)

To determine pathologic and pathophysiologic responses of pilots and other personnel exposed to high g forces of the type to be experienced in operational fighter aircraft of the 1980s.

Human subjects exposed to high g stress on the USAFSAM human centrifuge during experimentation under other work units will be given prestress and poststress examinations designed to elicit evidence of resultant strain or physical damage. Non-invasive cardiac evaluation using VCG, echocardiogram, treadmill stress testing, and serum isoenzymes will be emphasized. Invasively and noninvasively obtained physiologic data, such as arterial pressure and oxygen saturation, will be obtained from human volunteers during centrifugation, to evaluate and describe the cardiovascular, respiratory, and metabolic changes that occur during high-g aerial combat maneuvering, incidence of g-related pathologic changes in operational aircrew will be studied via compilation of anecdotal and epidemiologic data from fighter pilots and base flight surgeons. This work unit continues some efforts begun under work units 7930-13-09 and 7930-13-10, which have been terminated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, HEAT STRESS - EVALUATION AND GUIDANCE FOR USAF OPERATIONS

S.A. Nunneley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322590)

The goal of this effort is to set criteria for acceptable thermal stress in Air Force operations. Improved understanding of the mechanisms involved will allow development of useful predictive models as well as leading to new concepts for protective measures where stresses exceed permissible levels. Information derived will be used to provide guidance for USAF engineering groups and operational commands concerning design and use of environmental control systems and protective equipment.

Selected thermal conditions will be simulated in the laboratory where volunteer subjects can be intensively studied. The environments used will be based in part on field measurements obtained under other work units. Because physiological heat strain is a complex product of multiple factors, studies will include the effects of clothing on work rate and duration of exposure. The impact of vapor barrier clothing on heat tolerance will be tested for application to current maintenance practices as well as potential chemical defense requirements. The possible protective effects of acclimatization, physical fitness, and fluid replacement will be studied. Measurements will include core and skin temperatures, evaporative loss, heart rate, metabolic rate, body fluid composition, and performance. This effort supports the ASD development of aircrew equipment and the AFFDL development of advanced environmental control systems. Coordination is being accomplished with the US Army (ARIEM), USN, NASA, AFOSR, and civilian agencies. This work was formerly done under work unit 7164-17-24.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, POSITIVE PRESSURE BREATHING SYSTEMS TO INCREASE G TOLERANCE

R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322280)

To evaluate the efficacy of positive pressure breathing both with and without thoracic counter pressure garments as a method for improving acceleration tolerance, and secondly to establish optimum schedules and methods of application of positive pressure breathing in terms of acceleration level and breathing pressure.

The approach will be to establish the efficacy and feasibility of using positive pressure breathing to increase acceleration tolerance by testing pre-g onset of constant level positive pressure breathing both with and without counter pressure garments and anti-g suits against currently employed methods of acceleration protection. The evaluations will be conducted on the USAFSAM human centrifuge using two acceleration profiles, the first will test the subject's relaxed tolerance and the second will utilize straining techniques and evaluate fatigue tolerances in a rapidly changing acceleration environment (work unit 7930-12-07). If the use of pre-g positive pressure breathing proves effective, a second phase of experimentation will be initiated to determine optimum g levels for the onset of partial pressure breathing and breathing pressures per g level. This information will be used to develop criteria for a positive pressure breathing regulator (work unit 7930-11-XX) and the integration of positive pressure breathing with high oxygen concentration in the inspired gases as a method to reduce atelectasis which occurs during high g exposure (work unit 7930-11-20).

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, DEVELOPMENT OF A CAPABILITY TO AUTOMATE AMBULATORY BLOOD PRESSURE RECORDINGS

R.L. Wolthuis, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321680)

It is very difficult to differentiate between labile blood pressure elevations and fixed hypertension since blood pressure measurements cannot be made during routine daily activities. This effort will define the usefulness of ambulatory blood pressure measurements in identifying aircrewmembers who have significant hypertension and the effectiveness of drug therapy while on waiverable medications.

Two automated ambulatory blood pressure recorders have been manufactured and modified to this laboratory's specifications. This effort will define the reliability and accuracy of these recorders. The blood pressures recorded during routine ambulation will be correlated with the blood pressures obtained during orthostasis and exercise in normotensive and hypertensive aircrewmembers. This work was formerly documented under work unit 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, EFFECTS OF INSPIRED GASES ON THE METABOLISM OF PULMONARY SURFACTANT

R.J. King, University of Texas, Health Science Center at San Antonio, South Texas Medical School, Dept. of Physiology, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (DF048660; AFOSR-77-3323)

AF function - Air Force operating environments expose personnel to a wide variety of environmental stresses and potential hazards which can limit or degrade man's ability to perform effectively. These stresses include extremes of pressure and pressure changes, breathing gases and temperature extremes. These stressors are frequently experienced in combination with each other and with other factors such as high human operator work loads and mechanical forces. Deficiency - the use of elevated concentrations of oxygen is probably the most important single factor in the development of atalectasis in pilots of high-performance aircraft. Aviators breathing pure oxygen at reduced pressures are particularly susceptible to absorptional atalectasis and often experience this condition during a breath-hold or when airway ob-

struction occurs during exposure to acceleration. Objective - the overall objective is to provide information as to whether breathing oxygen at concentrations and durations employed by USAF crewmembers will affect the metabolism or function of pulmonary surface active material. How research contributes - this work will directly support subarea 1.6, 'Habitable Crew Environments in AF Operations'. It closely supports exploratory development work conducted under TPO 6, USAFSAM/VN.

These continuation experiments will be coordinated entirely under in vivo conditions. Animals will be exposed to 100 percent oxygen and injected with isotopic precursors to constituents of pulmonary surfactant. At varying times after injection the animals will be sacrificed, and the pulmonary surfactant in alveolar pools and in intracellular pools (purified type II cells) will be isolated. The incorporation of these precursors into surfactant will be followed with time. The results of these studies would provide information on the rate of matabolic turnover of surfactant in normal animals and in those exposed to oxygen, and would generate data reflecting possible differences in intracellular and extracellular (alveolar) pool sizes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0025, HYPEROXIA - LUNG METABOLISM AND MORPHOLOGY

J.A. Will, University of Wisconsin, Madison Campus, School of Agriculture & Life Sciences, Dept. of Veterinary Science, *Agriculture Hall, Madison, Wisconsin* 53706 (DF051220; AFOSR-78-3497)

AF function - Air Force operating environments expose personnel to a wide variety of environmental stresses and potential hazards. These stressors are frequently experienced in combination with each other and with other factors such as high human operator work loads and mechanical forces. The use of elevated concentrations of oxygen is probably the most important single factor in the development of atalectasis in pilots of high-performance aircraft. Aviators breathing pure oxygen at reduced pressures are particularly susceptible to absorptional atalectasis and often experience this condition during a breath-hold or when airway obstruction occurs during exposure to acceleration. Exposure of man to pure oxygen even at normal atmospheric pressure rapidly alters lung function and may cause pulmonary damage. Deficiency - USAF research into oxygen use procedures may be highly dependent on the results of this study. The potential complications of chronic oxygen administration to aircrew members is an area that must be investigated. The proposed relationship of biogenic amines to endothelial damage is appropriate. The study should allow the prediction of oxygen toxicity responses that cannot be experimentally measured in man. Objective - the objectives of this program are to 1) define animal models that are similar to man and which produce proliferative endothelium at low levels of hyperoxia as well as exudative lesions at high doses and acute exposure, 2) examine the dynamics of the pulmonary circulation in respect to endothelial function, capillary permeability, and the fate of biogenic amines by determining their transport in the lung and their fate if not removed at a normal rate, 3) examine lung function and the role of chemoreceptor function and possible rebound phenomena in hyperoxia and hyperbaria, 4) correlate function with morphology. How research contributes - this work directly supports subarea 1.5, 'Habitable Crew Environments in Air Force Operations.'

The research will study basic phenomena and their interactions in several species and under various conditions to determine the effects of hyperoxia acutely, with intermittent exposure, and after prolonged exposure. In all cases the functional changes that occur will be correlated with morphologic changes through the use of morphometric techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0026, DEVELOPMENT OF OCULOMOTOR FLYING SKILLS

D. Regan, Dalhousie University, *Halifax, Nova Scotia, Canada* (DF053390; AFOSR-78-3711)

AF function - this research supports AF flying training programs, especially air operations which are predominantly visually oriented. Deficiency - aircrew training in visual simulators has not taken advantage of current knowledge about oculomotor skills. There are several areas where properties of the eye which are important to flying could be improved by specifically designed visual stimuli. Objective -this research will explore the channel theory of vision to describe channels specifically sensitive to dynamic stimulus parameters which should be important for flying skills. Experiments will be conducted to see which of these sensitivities can be improved by training procedures. How research contributes - the knowledge gained from this research will impact the design of visual simulator systems, visual scene content, and instructional techniques. It appears especially applicable to flying tasks which are predominantly visual in nature, such as air combat maneuvering and air-to-ground weapons delivery.

Psychophysical methods will be used to describe the properties of information-processing channels in the human visual system that are preferentially sensitive to motion and to dynamic stimulus parameters. Civilian subjects will be studied to determine the range in sensitivities of each channel. These sensitivities will be compared to test results of experienced Air Force pilots to see what channels appear to be most developed in aviators. This data will be collected at USAF bases by a field researcher with portable equipment. Once the oculomotor skills critical for piloting have been identified, training procedures such as simple visual exercises will be developed to see if these skills can be improved in pilots.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, RADAR TRAINING FACILITY

V.J. Edwards, Computer Software Analysts Inc., *Los Angeles, California* 90071 (FA78WAI-920; FA161432 (TRAIS NO.))

This work statement describes support requirements for the Radar Training Facility (RTF) software development. This support will involve participation as an independent software verification and validation activity. This support will primarily consist of an automated audit and review of computer programs and tests and evaluations, data collection, data reduction and analysis, preparation of reports, and computer listings which verify and validate RTF software.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0002, TWO-DIMENSIONAL MESH ADJUSTMENT ALGORITHM

C.M. Ablow, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF048310; F49620-77-C-0114)

AF function - design of aerospace vehicles, study of nuclear weapons effects. Deficiency - the computation of functions with sharp variations requires small finite difference intervals for accuracy for certain regions while in other regions large intervals are needed for economy of computer time. Numerical techniques which eliminate or reduce the loss of accuracy due to mesh irregularity are needed. Objective -this research will investigate the use of a uniform mesh in a transformed coordinate system that expands the boundary layer in fluid flow problems. Extension of one-dimensional techniques to 2D will be studied. How work contributes - techniques which may offer a reduction in storage in the computer with same accuracy may be obtained.

This effort will attempt to establish a transformation of coordinates that facilitates the finite difference solution of partial differential equations in two dimensions. Analytical efforts will be spent to define the most campylotropic coordinate system for the solution of the PDE's. A rearrangement of the two-dimensional equations into uniquely solvable form will be derived. Methods

for the approximation of the derivatives by finite differences and solving the resulting algebraic system will be explored. Questions on the range of applicability of the methods developed will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, NUMERICAL METHODS FOR PROBLEMS ON ENVIRONMENTAL EFFECTS IN AEROSPACE VEHICLES

E.B. Saff, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Mathematics, *4202 Fowler Ave., Tampa, Florida* 33620 (DF038880; AFOSR-74-2688)

AF function - the design of chemical laser devices, the study of nuclear weapons effects on structures and aerospace vehicles. Opportunity - the use of Pade approximants to develop computational algorithms for solving the stiff differential equations arising in the application areas listed above may provide useful tools to engineers and scientists in the Air Force laboratories. Objective - this research intends to investigate certain outstanding stability questions involving linear multistep methods generated by the subdiagonal Pade approximation of exp (-z). How work contributes - results from this research may lead to more effective and stable numerical algorithms for solving stiff differential equations.

Areas to be explored include numerical implementation of recent results on rational and Pade approximation to solution of stiff systems of ordinary differential equations and numerical methods for solving certain nonlinear boundary value problems where nonuniqueness of solutions occurs. Topics occur such as astability of linear multi-step methods. Remez type of algorithms, implicit Runge-Kutta methods, contraction mapping, and the monotone operator approach to existence and convergence of approximating sequences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, COMPUTER SIMULATION OF KINETIC PROPERTIES OF PLASMAS

J. Denavit, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mech Engin & Astronautical Sci, *633 Clark St., Evanston, Illinois* 60201 (DN223216; N00014-75-C-0473)

Develop theory and numerical methods for plasma simulation and related problems in ionospheric and magnetospheric phenomena of interest to the Navy for application to communication systems via the ionosphere. Study very-low-frequency (vlf) emissions from the magnetosphere including the evolution of Whistler sideband instability and Whistler wave packets, and the stability of field-reversed ion rings.

Theory and computational methods are developed for simulation studies of the evolution of Whistler sideband instability under magnetospheric conditions. This includes extending the nonlinear evolution of Whistler wavepackets in a nonuniform external magnetic field to the case of a Whistler wave spectrum. Computer studies are also conducted on the stability of field reversed ion ring equilibria confining finite pressure plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, STOCHASTIC FILTERING AND CONTROL

T.E. Duncan, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Mathematics, *112 Bailey Hall, Lawrence, Kansas* 66045 (DF046660; AFOSR-77-3177)

AF function - the study of Air Force aerospace systems and conventional systems. Deficiency - the control of a linear system is a mathematically straightforward task. However most physical systems are inherently nonlinear and need new techniques for control. Objective -the objective of this research is to investigate the stochastic filtering and control of stochastic systems which are modelled by stochastic differential equations in the tangent bundle of a smooth manifold. How work contributes - success here would result in improved performance of physical Air Force systems.

Research will proceed in various problems in stochastic filtering and control. A study of the stochastic filtering problem for linear time delay differential equations will be pursued using algebraic-geometric methods which have been useful for the realization theory of systems described by these equations. The study of stochastic systems in manifolds will continue by constructing Brownian motion in some noncompact manifolds, studying special forms of stochastic systems whose structure groups are subgroups of the general linear group, and studying some stochastic systems in fiber bundles. In addition, a study of asymptotic estimates of exit probabilities will be started for some controllable stochastic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, SPECTRAL METHODS FOR COMPRESSIBLE FLOW PROBLEMS

S.A. Orszag, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF049510; AFOSR-77-3405)

AF function - the design of chemical laser devices, the design of jet engine and engine nacelles for future aircraft. Deficiency - these design problems are hampered by the lack of effective and efficient computational techniques to solve shock wave-boundary layer interaction problems. Objective - this effort will investigate the utility of the spectral methods in solving several classes of compressible flow problems and the application of results to the problem of shock wave-boundary layer interaction. How work contributes-techniques may be developed which are useful in solving problems in lasers and aircraft design.

This research involves the study of the properties of spectral methods for the numerical solution of systems of non-linear hyperbolic equations with nonperiodic boundary conditions. A special case to be considered is the system of inviscid compressible Navier-Stokes equations. Questions of stability and convergence arising in connection with polynomial spectral methods will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, NUMERICAL ANALYSIS AND MACHINE COMPUTATIONS

P.J. Nikolai, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136330)

Computational algorithms are necessary for improved analysis and simulation of performance in the development complex weapons and delivery systems, but in many cases the algorithms are unavailable, and in others they are inadequate. The goal of this work is to develop practical, effective and efficient algorithms for the solution of numerical problems arising in typical computing tasks which occur repeatedly in different settings. Research is concerned with more accurate and efficient solution of the algebraic eigenvalue problem and the solution of large systems of linear algebraic equations, both basic computations in the analysis of loading of flight vehicle structures. This work leads naturally to wide-ranging consulting activities in regard to implementing computer algorithms, to efficient use of available computing resources and to procuring additional computing resources should this prove desirable.

The computational algorithms selected for analysis and implementation are determined by requirements arising within the task and by needs communicated through consulting activities within the laboratory as a whole. A given computational requirement may be satisfied by various competing methods. Algorithms arising from these methods are analyzed and evaluated for possible implementation as subroutines for available digital computers. These studies emphasize the extension of existing theory and the development of new algorithms when a realistic survey of existing methods reveals deficiencies either in performance or documentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0008, MATHEMATICAL SIMULATION OF THE CARDIOPULMONARY SYSTEM

R.E. Collins, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DF041800; AFOSR-76-2905)

AF function - aircrew members operating high-performance aircraft such as the F15 and F16 are exposed to increasing levels of rapid onset, long duration, repetive g-forces. Data from USAFSAM and other research facilities indicate that the effects on the cardiopulmonary system may be the limiting factor in pilots' performance in air combat. Deficiency -a good physiological model of the cardiopulmonary system under g-stress is needed to provide human performance modelers the means to optimize combat tactics. Objective - the objective of this effort is to develop a mathematical model of the cardiopulmonary system capable of predicting physiological responses to aerial combat maneuvering forces. How research contributes - ultimately the complete model will be used to simulate cardiopulmonary response to ACM g-profiles. These studies will compare the predictions of this model to data obtained using the ear oximeter. As feedback and control mechanisms are added to the model, the model should provide total simulation of combined effects of varied g-profiles with g-suits, various breathing maneuvers, positive pressure breathing and variations of oxygen supply.

The proposed research is the continued development and application of a mathematical model of the cardiopulmonary system. This model consists of a multi-chambered lung model coupled to a multi-chambered circulatory model specifically designed to simulate the response of human subjects to whole body accelerations. Programming and debugging of the pulmonary portion of the model have been completed. The circulatory portion of the model has been programmed, and debugged and all system parameters determined. Currently this circulatory model is being tested for a change in gravity and interfacing of the pulmonary and circulatory models has been initiated. It is expected to have the complete model, exclusive of feedback systems, operational very shortly.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, COMPUTATIONAL METHODS IN NONLINEAR MECHANICS

J.T. Oden, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (DF052690; F49620-78-C-0083)

AF function - design of future lightweight aerospace vehicles will require an improved knowledge of failure modes and nonlinear behavior in order to achieve a high degree of reliability. Opportunity - new analysis methods which accurately predict nonlinear failure mechanics will have a major impact on future vehicle designs. Objective - to develop new solution methods, convergence criteria and error estimates to nonlinear elasticity problems of the following classes: 1) large deformations, 2) stress singularities, and 3) interface contact. How work contributes - results of this research contribute to the improvement of AF structural analysis methods and methodologies.

For the classes of problems listed in the objective above, several different methods of formulation may be needed to achieve acceptable numerical techniques. It is planned to investigate the use of variational inequalities, penalty methods, Lagrange-multipliers and regularization methods. In order to assess the reliability of these methods for each of the problem classes the development of a priori error estimates will be undertaken. This study will lead to criteria of element trial functions which will guarantee convergence. Finally, the methods will be implemented through computational solutions to verify the accuracy and convergence of the procedures as well as additional special features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ATOMIC PHYSICS

R. Marrus, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

The following subjects are being studied: atomic physics of highly stripped heavy ions, oscillator strength and wavelength measurements; study of transitions in two-electron atoms of high Z; quenching of the metastable state of Ar/sup 17/ in an external electric field, study of x-ray transitions using a new method of precision x-ray measurement, search for intense UV transitions in ionized iron and molybdenum elements (which are important contaminants of fusion plasmas). (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0002, EXPERIMENTAL SOLID-STATE PHYSICS AND QUANTUM ELECTRONICS

Y. Shen, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720

Modern optical techniques are used to study linear and nonlinear optical properties of materials. The materials under investigation include gases, liquids, liquid crystals, metals, semiconductors, and magnetic crystals. Newly developed optical techniques are applied to current problems of interest, such as laser isotope separation, photochemistry, and surface phenomena. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0003, LIGHT-SCATTERING STUDIES OF THE FAR INFRARED DIELECTRIC PROPERTIES OF SEMICONDUCTORS

S. Ushioda, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DF047080; AFOSR-77-3222)

AF function - aerospace communications surveillance and detection systems require electroptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - infrared materials research has high potential for airborne and satellite applications. Sophisticated electrooptical techniques and characteristics of narrow band-gap compound semiconductors offer promise for electroptical microcircuitry in the spectral range 10 to 100 microns. Objective - the main purpose of this research is to explore the far infrared dielectric properties of several semiconductors, in the bulk and near the surface, by means of inelastic laser light scattering spectroscopy, and to study elementary excitations that contribute to the dielectric properties such as phonons, bulk and surface polaritons, plasmons, and low-lying single particle electronic excitations. How work contributes - the far infrared dielectric (optical) properties of these semiconductors are important to the development of infrared detectors, solid state lasers, integrated optics and electroptical techniques and devices concepts.

Laser Raman spectroscopy utilizing tunable dye lasers is being used to probe the far infrared properties of semiconductors. For the study of the surface layers of III-V and II-VI compound semiconductors, back-scattering Raman spectroscopy is being used. For the study of surface polaritons, thin film layered structures are being used. A computer-controlled spectrometer which is capable of extremely long time signal averaging and digital processing is being utilized to detect very weak Raman scattering. The behavior of surface polaritons, plasmons and phonons is being related to the optical properties and electronic structure of such materials as (Hg, Cd)Te, PbTe, GeTe, GaAs, GaP, InSb, InAs and related semiconducting compounds and alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, SPACE APPLICATIONS OF SUPERCONDUCTIVITY

D.B. Sullivan, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2750487)

PROJECT OBJECTIVE: To study a broad range of superconducting devices and methods of metrology which would be appropriate for the rigorous demands of space missions and to identify development needs.

PROJECT APPROACH: The study is to be divided into 6 general categories. They are: low-frequency sensors, high-field magnets, digital electronics, microwave and infrared detectors, ultra high-Q cavities, and miscellaneous applications. Each category will be handled by an individual NBS staff member with expertise in the particular study area. Depending on emphasis the time allocated to each category will vary from 3 to 5 weeks. A study coordinator will perform interface functions with NASA and collect and edit a final report.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0005, LASER SPECTROSCOPY OF SOLID-STATE ELECTROLYTES

J.F. Scott, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DF046000; AFOSR-77-3105)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power from nonnuclear energy sources. In particular, the use of superionic conductors as solid electrolytes has high potential for development of new batteries and energy storage devices. These batteries will be used for electrical power in unattended ground-based systems. Deficiency - substantial improvements are needed in organic and solid electrolytes to increase conductivity to that achieved in aqueous electrolytes. These solid electrolytes have a much wider temperature range and are needed to be used in new high-energy, high-charge and discharge rates rechargeable batteries in future aircraft applications as well as space applications. Objective - laser spectroscopy is to be used to study electrolytes of the silver-iodide tungstate system, which includes at least three phases. these electrolyte phases are among the most promising for silver-iodine batteries. Related studies are proposed on pyridinium silver iodide. Contribution - this research is a part of a comprehensive program in superfluids and superconductors.

Pure silver tungstate crystallizes in two forms. The so-called high-temperature modification is stable (or metastable) at room temperature and has a C(2V) point group symmetry. Although it is only slightly distorted from a centric D(2H) structure, efforts to switch its pyroelectric domains with fields up to 40 kv/cm have been unsuccessful. The main thrust of the spectroscopy is to determine high-temperature structural and chemical information concerning Ag(2)Wo(4) and its iodated forms, for example, the presence of structural phase transitions, the onset and degree of disorder, evidence for mobility of silver ions, stability in oxygen, and irreversible chemical degradation. These studies differ considerably from the infrared and Raman spectroscopy done previously on the silver aluminates and gallates and the calcium fluoride family, where primary emphasis has been upon the microscopic details of Ag ion hopping. Our attention is focussed on more practical aspects, important to device fabrication, of stability and decomposition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, THEORETICAL SOLID-STATE PHYSICS

M.H. Cohen, University of Chicago, School of Physical Sciences, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DMR7712637A01)

Theoretical studies of condensed matter systems previously supported by NSF grant DMR-7621298 will be continued and extended in new directions. Topics to be investigated include the following: (a) one-dimensional and nearly one-dimensional systems with emphasis on electron-lattice interaction, transport and magnetic properties of one-dimensional materials and on nonlinear dynamics of a one-dimensional field theory; (b) properties of liquid and superfluid helium-3 including study of the pairing mechanism and a search for an explanation of the phase diagram in zero and finite magnetic field; (c) disordered systems including an attempt to explain static and dynamical properties of the spin glasses in a cluster mean field theory and to formulate an itinerant model of a spin glass; (d) critical and collective phenomena including work on the equilibrium properties and dynamics of classical quantum mechanical systems near critical points; (e) dynamics of fluids including work centered on kinetic theory approaches to the description of quantum and classical fluids and plasmas; (f) metal-insulator transition including work on a new method for deriving the Green's function for the Hubbard model.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, NUCLEAR SCIENCE AT THE CYCLOTRON LABORATORY

D.L. Hendrie, University of Maryland, College Park Campus, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY7820749)

The proposed grant is for support of research in nuclear science with the University of Maryland cyclotron. The high-intensity, high-quality beams of protons, deuterons, 3He, and 4He from this accelerator will be used in various studies of fundamental processes in nuclear reaction mechanisms, nuclear structure, and nuclear astrophysics.

The global properties of charged-particle reaction cross sections will be studied with beams in the energy range up to 100 MeV/A. The giant multipole resonances of nuclei will be studied via inelastic excitation with proton, deuteron and 4He beams and by nucleon-transfer and charge-exchange reactions as well. Their various decay modes will also be the subject of detailed investigation. The existence of clusters of nucleons in the nuclear surface will be studied with proton and 4He induced 'knock-out' reactions. Nuclear sizes and surface features will be studied with proton and 4He elastic scattering, in coordination with complementary studies at other laboratories with electrons and 800 MeV protons.

Other research areas which will be addressed include radiative-capture reaction studies with high-energy protons, nuclear reactions of relevance to theories of astrophysical evolution, formation of isotopes far from beta stability, exploratory heavy-ion reaction studies and applications to astronomy, biology, materials research and trace analysis.

This project is a continuation of that currently supported by NSF grant PHY76-19498 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0008, HIGH-TEMPERATURE PLASMAS

D.A. Boyd, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY7726042A02)

Experimental and theoretical research on High-Temperature Plasmas will continue, including the two main topics: 1. Investigations of the fundamental equilibrium, stability, and synchrotron radiation properties of magnetically confined nonneutral plasmas. 2. Studies of the synchrotron radiation emitted by tokamak plasmas, including use of the emitted radiation as a diagnostic tool for the plasma utilizing the Princeton Large Tonus (PLT) Tokamak.

This research is a continuation of that currently supported under NSF grant PHY77-26042.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, A PARAMETRIC STUDY OF THE EMP INTERACTION WITH AN AIRCRAFT OVER A LOSSY GROUND PLANE

T.T. Crow, Mississippi State University, School of Arts & Sciences, Dept. of Physics, *102 Experiment Station Bldg., Mississippi State, Mississippi* 39762 (DF053110; AFOSR-78-3667)

AF function - a number of simulation facilities have been constructed to test the response of aircraft and missile to the nuclear EMP. In each of the existing facilities the aircraft must rest on a concrete pad which eliminates the possibility of testing the inflight mode response or the tests must be conducted as the

aircraft flies by the simulator which in turn presents its own particular difficulties. Opportunity - a theoretical model is needed for the interpretation of the 'fly-by' test data as well as for the extrapolation of the test data from ground-based measurements to predict the inflight mode response. Objective - a determination of the aircraft skin current and charge when the aircraft is under illumination of nuclear EMP and in the ground alert mode. Contribution - this work will provide analytic models for the determination of induced skin currents and charges by external electromagnetic pulses.

The dyadic Green's function for a lossy half space will be derived and the Green's function extended to the complex s plane. An SEM representation for the integral functions will be derived aiming toward a numerically efficient means of calculating the dyadic Green's function integral equations for a thin wire horizontal to a lossy half space and for perpendicular crossed wires over a lossy half space will be derived. Next, approximate analytic solutions and numerical solutions will be obtained for the wire currents.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0010, DRIVEN AND SPONTANEOUS DISSOCIATION OF MOLECULES 14473-P

E. Montroll, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DA0F8902; DAAG29 77 G0060)

To investigate theoretically the nonlinear dynamics of the dissociation of medium-sized molecules as well as the nonlinear dynamics of the generation of shock waves in crystalline solids. Relevance - the proposed work is directly relevant to on-going work on energetic processes in metastable materials at Picatinny Arsenal, to shock wave propagation studies at BRL, and to molecular dynamics calculations on metals at AMMRC. It also has broader potential relevance to areas involving chemical reactions, phase transitions, propagation of heat through solids, etc.

Both classical and quantum mechanical analytical (rather than numerical) approaches developed by the P.I.'s will be used - specifically, series expansions will be used that are so rapidly convergent that a few analytic terms will suffice. Also, exploit high-speed computers to do bookkeeping on the terms so as to go to extremely high orders and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0011, CARBON FIBERS - STRUCTURAL INFORMATION FROM ELECTRONIC PROPERTIES

J.W. McClure, Oregon State Higher Education System, University of Oregon, School of Arts & Sciences, Dept. of Physics, *Johnson Hall, Eugene, Oregon* 97403 (DMR78-09047)

This project will be a theoretical study of electronic properties to gain structural information about carbon fibers, i.e., more exact knowledge of the basic structural unit, the defects present in it, and the connections between basic structural units. Present experimental results on the magnetic susceptibility of carbon fibers will be used to develop and improve upon a theory of the magnetic susceptibility of graphitic ribbons which can predict the size of these structural defects. The theory will be extended to treat a more realistic edge boundary case, ribbons of finite length, and ribbons containing impurities and defects. Theoretical studies will also be initiated to examine how other electronic properties such as thermoelectric power and electrical resistivity can be used to predict structural information about carbon fibers.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, PROCEDURE TO PREDICT AIRCRAFT NOISE IN COMMUNITIES

D.E. Bishop, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF320240; F33615-77-C-0528)

NOISEMAP is a fully computerized procedure for predicting the noise exposure produced by the multiplicity of aircraft flight and ground runup operations at an air base. NOISEMAP is the methodology officially used by the air staff for preparing/assessing environmental noise impact and conducting compatible land use planning studies. The objective of this research is to insure NOISEMAP remains the state-of-the-art tool for predicting noise exposure about air installations.

The contractor will conduct detailed analytical studies and development work to refine and update the community-aircraft noise exposure (NOISEMAP) predictive model. Areas of investigation include improving the overall operating efficiency, application guidelines, and excess ground attenuation models. The contractor will determine the feasibility of expanding NOISEFILE and NOISEMAP to include helicopter operations. The contractor will develop a detailed test protocol for improving the current model used for excess sound attenuation. Studies will be made to determine the practical engineering and economical problems inherent in developing and applying demographic and compatible land use overlays with noisemap as indices of relative environmental noise impact.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

9.0002, PILOT PROGRAM TO DEVELOP AGGREGATE BASE OPERATING SUPPORT WORKLOAD INDICATORS FOR USE IN AIR STAFF-LEVEL MANPOWER MANAGEMENT

R.L. Somers, General Research Corp., *7655 Old Springhouse Rd., McLean, Virginia* 22101 (DF051680; F49620-78-C-0048)

AF function - manpower resource management within the Air Force involves determining, compiling and projecting future manpower requirements, documenting these requirements, integrating them into the overall defense planning, programming and budgeting process, justifying them to OSD, OMB and Congress, and translating them into a form which provides a basis for personnel procurement, training and assignment actions. The process is dynamic and encompasses interrelated activities at field, major command and Department of the Air Force levels. Field management engineering teams (METs) develop detailed manpower requirements with Air Staff Directorate of Manpower and Organization (AF/PRM) policy guidance, and technical direction from the Air Force Management Engineering Agency (AFMEA). Deficiency - manpower standards developed by the METs provide rationale and methodology for distribution of manpower by the major commands. Similar, but more aggregate, standards are required by AF/PRM to support the overall justification and allocation of manpower. Objective - the research will develop and validate a methodology for the derivation and application of aggregate base operating support (BOS) workload indicators through a pilot or feasibility test. How contributes - workload measures will be expressed in terms of input (man-years)/output (aggregate work units or representative workload indicators) relationships for BOS functions, functional groupings and program elements (PEs). They will be designed for application to internal manpower management problems, such as evaluation of command requests for increases and allocations of reductions and justification of requirements to OSD, OMB and the Congress.

The research will involve the actual derivation of aggregate workload indicators/manpower relationships for selected BOS functions, PES and commands on a pilot-test basis. Accepted technique for curve fitting and the drawing of statistical inferences will be applied. Efforts will be made to resolve anomalies and clarify questionable analytical results. Problems and limitations will be fully documented, along with a recommended approach for continuing Air Force development and application of aggregate workload indicators for management of manpower resources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, A SEARCH FOR BURSTS OF HARD GAMMA RAYS

T.C. Weekes, Smithsonian Institution, Astrophysical Observatory, Center for Astrophysics, *P.O. Box 97, Amado, Arizona* 85640 (71702122)

A burst of hard gamma rays (of energy greater than 200 MeV) will produce Cerenkov light in the atmosphere which can be detected at ground level using simple light receivers. These bursts of gamma rays have been predicted to occur from the evaporation of primordial black holes. We propose to run a system of separated Cerenkov light receivers whose parameters will be optimized to detect such bursts.

SUPPORTED BY Smithsonian Institution, Office of Fellowships and Grants

10.0002, EMISSION-LINE ANALYSIS OF NOVA SHELLS

R.E. Williams, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST7715865A01)

This research will be concerned with the analysis of the conditions that exist in the shells of novae. There are a number of shells which can be studied spectroscopically, including the stars T Aur, CP, Pup, V476 Cyg, and T Pyx. Spectral scans will be obtained of a shell which has been found to surround the nova T Pyx. It is the only well-developed shell around a recurrent nova, and it may help provide some insight into the differences between ordinary novae and recurrent novae. There will be a study of the spectra of the unresolved components of old novae systems. The emission from these systems is believed to originate from a disk of material which surrounds the nova. Little is known about the geometry of these unresolved systems, and there is considerable uncertainty as to the processes which produce the emission spectrum. There will be an investigation of the mechanisms which give rise to spectral features which consistently appear in certain classes of novae but not in others.

There will be a comparative study made of the spectra of old novae and stars which are known as magnetic variables. The spectra of these variables have features in common with novae.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, OBSERVATIONAL STUDIES IN GALACTIC AND EXTRAGALACTIC ASTROPHYSICS

B.T. Soifer, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (AST7682890A02)

Infrared spectrophotometric observations of galactic and extragalactic sources will be carried out. The UCSD-U. Minn. Mt. Lemmon Observatory and the 3-m telescope of Lick Observatory will be used. Necessary improvements will be made in the multidetector, grating spectrometer in order to increase the ultimate sensitivity of infrared spectroscopy.

The infrared observations will consist of moderate resolution lambda/delta 70) spectrophotometry from 2 to 4 and 8 to 13 microns. Galactic sources to be studied are those that might exhibit the unidentified spectral features discovered in NGC 7027, newly discovered sources, and chemically peculiar stars. Extragalactic sources to be studied include some of the brightest quasistellar objects in which optical emission lines are redshifted into the 2 micron m window. A few of the brightest infrared galaxies will also be observed.

In developing the grating spectrometer, the aim is to build the most efficient instrument possible and to test and demonstrate its performance. The use of an up-looking configuration, Fabry field optics, and the best demonstrated photoconductors were dictated by this aim. They shall test the spectrometer on the Mt. Lemmon telescope, make any necessary improvements, test and improve the data acquisition and reduction techniques, and use the system for useful astronomical observations.

This is a continuation of AST-7682890.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, SPECTROSCOPIC STUDIES OF EARLY STELLAR EVOLUTION AND OF THE CONSTITUENTS OF DENSE INTERSTELLAR CLOUDS

G.H. Herbig, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy & Astrophysics, *Santa Cruz, California* 95060 (AST7726404A01)

This grant will provide support for a program of spectroscopic investigations of young stars and interstellar material. The work will be aimed at increasing our knowledge of the very early stages of star formation. There will be a series of studies at high, intermediate and low resolution. High resolution studies will include searches for weak interstellar lines of molecules, searches for fine structure in diffuse interstellar absorption bands, and studies of lithium isotope ratios in stars. There will also be studies of spectroscopic binaries among T Tauri stars. A survey will be made of stellar associations which are rich in T Tauri stars. There will also be studies of rotation in solar-type stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, STUDIES IN STELLAR STRUCTURE AND EVOLUTION

I. Iben, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST7820124)

This grant will provide funds for a study of the late stages of evoluion of single stars, with emphasis on the evolution of stars of intermediate mass. The question of whether carbon will ignite explosively in such star will be investigated. There will be investigations of nucleosynthesis in the shells of thermally pulsing stars. These projects will be carried to completion and several new investigations will be initiated. These investigations will include a study of the evolution of deep interior of a star after all of the carbon at the center of the star has undergone thermonuclear reaction. There will be a study of the late stages of evolution of massive stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, THEORY OF THE INTERSTELLAR MEDIUM

W.D. Watson, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy & Physics, *Urbana, Illinois* 61801 (AST7823648)

Research on theoretical topics related to the interstellar medium will be carried out. The solution to microscopic problems involving atoms, molecules, and solids that play a key role in global astrophysical questions will be emphasized. These include: isotope fractionation and the electron density in dense interstellar clouds, interstellar molecule formation in general, charge-transfer between atoms, the excitation and masering of interstellar microwave radiation, and processes involving grains.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, ECHELLE SPECTROMETER MEASUREMENTS ON THE INTERSTELLAR MEDIUM

F.H. Chaffee, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-04)

Atomic and molecular absorption lines of many species have been detected in the spectra of several stars in the Perseus region. The measured abundances provide an appreciable body of new data that allows detailed comparison with theoretical predictions. Certain broad aspects of the current theory of molecular abundances are confirmed, but the theory is shown not to explain the details of abundances.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0008, STELLAR PHYSICS - SOLAR AND STELLAR OBSERVATIONS AND ANALYSIS
R.W. Noyes, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Div, *60 Garden St., Cambridge, Massachusetts* 02138 (31S-4S50-06)

Observations were conducted and data analysis begun from the Harvard College Observatory extreme ultraviolet spectrometer on Skylab to study physical conditions in the solar chromosphere and corona. Main areas of study include heating and energy balance of the corona, structure of active regions, prominences, coronal holes, solar flares, etc. Data analysis will continue for several years.

Observations of G stars were made using the Copernicus satellite. MgII (K-line) was detected, and further observations will be made to detect the H-line. Observations and analysis of the data are continuing.

Observations in the far infrared spectrum were made, in cooperation with the Harvard College Observatory, using a 40 inch telescope launched on a high-altitude balloon.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0009, GAMMA-RAY STUDIES
T. Weekes, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

A large optical reflector is being used at Mount Hopkins, Arizona, to search for Cerenkov light produced by celestial gamma rays interacting in the atmosphere. The detector is sensitive to photons with energy greater than 10 to the 11th power electron volts. Objects such as the Crab Nebula, quasi-stellar radio sources, radio galaxies, pulsars, and X-ray stars are being investigated as gamma-ray sources.

The necessary phototubes were purchased and modifications were made to the holder on the telescope to accommodate larger tubes.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0010, THEORETICAL GALACTIC DYNAMICS AND HIGH-ENERGY ASTROPHYSICS
J.P. Ostriker, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST7620255 A02)

Theoretical research will be directed toward a number of astrophysical topics. Answers will be sought to questions such as: In what form is the dark mass which we know exists in the outer parts of galaxies? Is there any simple way that the Hubble sequence of galaxy forms can be understood as a variation of a single parameter defining the initial state of a protogalaxy? Is either the size or mass of galaxies understandable from physical principles or are these broadly distributed parameters having no preferred values? Could they be large black holes accreting diffuse gas? Can the energy (rather than momentum) absorbed by accreting gas be so large as to inhibit the accretion giving a limit like the Eddington limit? Will turbulence in the accretion disc produce hot coronae and winds, thus invalidating the assumptions on which the standard models for X-ray sources are based? Do embedded pulsars make a significant contribution to supernova dynamics? Can the collection of galactic supernova effectively sweep out almost all of the intercloud medium producing the hot gas seen by the Copernicus satellite? The questions are a sample of those that will be considered in this research.

This is a continuation of research previously supported under NSF grant AST76-20255AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, ENCYCLOPEDIA OF CURTISS AIRCRAFT
L.S. Casey, Smithsonian Institution, Dept. of Aeronautics, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

Research directed to the determining of chronological development of the Curtiss aircraft. Curtiss was the most prolific designer and producer of aircraft during the period immediately following the Wright aircraft. Determining the technological progression of the series has never been accomplished to this date.

The first volume of this series has been completed and is expected to be published by the end of 1977.

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VOLUME 17 NUMBER 15 / AUGUST 8, 1979

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-23888*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CHARACTERISTICS OF THE ADVANCED SUPERSONIC TECHNOLOGY AST-105-1 CONFIGURED FOR TRANSPACIFIC RANGE WITH PRATT AND WHITNEY AIRCRAFT VARIABLE STREAM CONTROL ENGINES
Hal T. Baber, Jr. Mar. 1979 134 p refs
(NASA-TM-78818) Avail: NTIS HC A07/MF A01 CSCL 02A

Credence to systems weights and assurance that the noise study AST concept can be balanced were studied. Current titanium structural technology is assumed. A duct-burning turbofan variable stream control engine (VSCE), with noise reduction potential through use of a coannular nozzle was used. With 273 passengers, range of the AST-105-1 for a cruise Mach number of 2.62 is essentially transpacific. Lift-to-drag ratio is slightly higher than for previous AST configurations. It is trimmable over a center-of-gravity range of 4.7m (15.5 ft). Inherent high positive effective dihedral, typical of arrow-wing configurations in high-lift approach, would limit AST-105-1 to operating in crosswinds of 11.6 m/sec (22.4 kt), or less, with 75 percent of available lateral control. Normal power takeoff with cutback results in noise in excess of Federal Aviation Regulation Part 36 but less than for conventional procedure takeoff. Results of advanced (noncertificated) programmed throttle takeoff and approach procedures, not yet optimized, indicate that such can be an important additional method noise reduction. S.E.S.

N79-23889*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE SCIENCE AND TECHNOLOGY OF LOW SPEED AND MOTORLESS FLIGHT, PART 1
Perry W. Hanson, comp. 1979 299 p refs Conf. held at Hampton, Va., 29-30 Mar. 1979; cosponsored by NASA and the Soaring Soc. of America
(NASA-CP-2085; L-12973) Avail: NTIS HC A13/MF A01 CSCL 02A

The proceedings of the Third International Symposium on the Science and Technology of Low Speed and Motorless Flight are reported. Twenty-eight papers were presented in the areas of low speed aerodynamics, new materials applications and structural concepts, advanced flight instrumentation, sailplane optimal flight techniques, and self launching and ultralight glider technology. These papers are included in the document along with another paper, which was not presented, on proposed definitions for various categories of sailplanes and gliders. For individual titles, see N79-23890 through N79-23903.

N79-23890*# Boeing Commercial Airplane Co., Seattle, Wash.
LOW-SPEED SINGLE-ELEMENT AIRFOIL SYNTHESIS c02
John H. McMasters and Michael L. Henderson *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 1-31 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

The use of recently developed airfoil analysis/design computational tools to clarify, enrich and extend the existing experimental data base on low-speed, single element airfoils is demonstrated. A discussion of the problem of tailoring an airfoil for a specific application at its appropriate Reynolds number is presented. This problem is approached by use of inverse (or synthesis) techniques, wherein a desirable set of boundary layer characteristics, performance objectives, and constraints are specified, which then leads to derivation of a corresponding viscous flow pressure distribution. Examples are presented which demonstrate the synthesis approach, following presentation of some historical information and background data which motivate the basic synthesis process. G.Y.

N79-23891*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPLORATORY INVESTIGATION OF THE EFFECT OF PLASTIC COATING ON THE PROFILE DRAG OF A PRACTICAL-METAL-CONSTRUCTION SAILPLANE AIRFOIL c02
Dan M. Somers *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 33-64 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

An exploratory investigation was performed in the Langley low-turbulence pressure tunnel to determine the effect of a plastic coating on the profile drage of a practical-metal-construction sailplaine airfoil. The mode was tested with three surface configurations: (1) filled, painted, and sanded smooth; (2) rough bare metal; and (3) plastic-coated. The investigation was conducted at Reynolds numbers based on airfoil chord of 1,100,000, 2,200,000, and 3,300,000 at a constant Mach number of 0.10. The results indicate that, at all three Reynolds numbers, the order of the drag values of the three surface configurations, starting with the highest drag, was: filled, painted, and sanded smooth; rough bare metal; and plastic-coated. G.Y.

N79-23892*# Technische Hochschule, Darmstadt (West Germany).
OPTIMUM TAIL PLANE DESIGN FOR SAILPLANES c05
Kay Mayland *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 65-80 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

Classical drag equations in a modern version were used to calculate the influence of tail modifications on the drag of a standard class sailplane. The profile drag which depends on the Reynolds number is included in the calculations. Minimum drag is compared with real drag for two lift coefficients. Some results have no clear tendency but low tail area and relatively low tail aspect ratio give some advantages. Optimum and real lift ratios between wing and tail plane are compared for the original sailplane. G.Y.

N79-23893*# Stuttgart Univ. (West Germany).
THE EFFECT OF DISTURBANCE ON A WING c02

Richard Eppler *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 81-92 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

Disturbances such as flap and aileron hinges and poorly faired spoilers were simulated in a computer wind tunnel. The total drag of a single roughness element does not depend only on the size of that element. Its position on the wing has a surprisingly strong effect. In particular, a roughness element on the convex side of a deflected flap or aileron causes a very substantial increase in drag. Very few experimental data are available for comparison. Good agreement with experiment can be achieved, however, by adapting a fictive step size. The correlation between the real roughness-element size and the drag increase remains to be determined. Simple, fundamental experiments are suggested which will allow a theoretical estimation of the drag increase due to roughness elements. G.Y.

N79-23894*# Technische Univ., Berlin (West Germany).
GENERATION AND BREAKDOWN OF AERODYNAMIC LIFT: PHYSICAL MECHANISM **c02**
Wolfgang Liebe *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 93-102 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 02A

A contribution is given to an old problem: the explantion of the generation of aerodynamic lift. Physical models are described which provide a better understanding of the phenomena involved. G.Y.

N79-23895*# Bertelsen Mfg. Co., Inc., Neponset, Ill.
INTRODUCTION TO THE ARCOPTER ARC WING AND THE BERTELSEN EFFECT FOR POSITIVE PITCH STABILITY AND CONTROL **c08**
William D. Bertelsen *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 103-130 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

A brief report, offered on a wing design, new in geometry, construction, and flight characteristics. Preliminary wind tunnel data on a three-dimensional model was well as some full-scale man-carrying test results are included. There are photos of all phases of the experiments and some figures which serve to illustrate the Bertelsen Effect, a unique focus of aerodynamic forces in the arc wing system which allows the attainment of high lift coefficients with the maintenance of pitch stability and control. G.Y.

N79-23896*# Stuttgart Univ. (West Germany).
SOME NEW AIRFOILS **c02**
Richard Eppler *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 131-154 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

A computer approach to the design and analysis of airfoils and some common problems concerning laminar separation bubbles at different lift coefficients are briefly discussed. Examples of application to ultralight airplanes, canards, and sailplanes with flaps are given. G.Y.

N79-23897*# Princeton Univ., N. J.
A COMPARISON OF THE AERODYNAMIC CHARACTERISTICS OF EIGHT SAILWING AIRFOIL SECTIONS **c02**
Mark D. Maughmer *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 155-176 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

The operational characteristics of sailwings are discussed with emphasis placed on the importance of the trailing edge cable tension. The three dimensional aerodynamic characteristics were obtained from wind tunnel tests, and the results compared to determine the magnitude of the aerodynamic penalties paid for various structural simplifications. For the sectional thickness ratios, it is concluded that, while the basic double-membraned sailwing has exceptional aerodynamic performance, even superior for some applications to the conventional hardwing, any notable deviation from this configuration results in an unacceptably large performance penalty. S.E.S.

N79-23898*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
LENGTH AND BURSTING OF SEPARATION BUBBLES: A PHYSICAL INTERPRETATION **c02**
John M. Russell *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 177-202 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

A physical interpretation of the observed form of the pressure distribution beneath a two-dimensional separation bubble which modified the external inviscid pressure distribution only locally is given in terms of boundary layer concepts. A simple method for estimating along a mean streamline entrained into the underside of a growing shear layer through the transition region is discussed, and predictions of bubble bursting conditions and a lower bound on the bubble length are compared with experiment. S.E.S.

N79-23899*# Rensselaer Polytechnic Inst., Troy, N. Y.
WING SHAPE OPTIMIZATION FOR MAXIMUM CROSS-COUNTRY SPEED, WITH MATHEMATICAL PROGRAMMING **c05**
Gunter Helwig *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 203-218 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

A computer program was developed to calculate numerically the speed and circling polars of an aircraft when the lift and drag characteristics of the wing airfoils are known. The planform of the wing is described by variables which are optimized so that the cross-country speed of the glider is maximum for the particular type of thermal model. Two thermal models are compared and shown that with a greater wing area than now normally used the performance can be increased. Author

N79-23900*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FURTHER DEVELOPMENTS IN SIMPLE TOTAL ENERGY SENSORS **c35**
Oran W. Nicks *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 219-246 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 14B

A simple total energy probe concept using principles of laminar flow around a cylinder and pressure distribution is reviewed and flow fields around cylinders normal to and inclined to the flow are described. A variety of bent-up probe configurations were tested to explore variations in geometry. Test results are presented on the effects of sensor length, hole location, and angle of sweep. Comparisons are made with other probe tests reported in the literature. Damping restrictors and their use in filtering gusts are summarized. Flow field effects, indicating the variables involved for different mounting locations on aircraft, are discussed. S.E.S.

N79-23901*# Soaring Society of America, Los Angeles, Calif.
HOW ACCURATE IS NETTO **c06**
Stephen duPont *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 247-266 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01D

The historical origin and general history of vertical current total energy variometer, including its optimum airspeed selector ring are reviewed, and some later developments of it are discussed. Polars of three sailplanes of different spans are charted for straight and circling flight, then plotted to reveal their parabolic anomaly and the effect of circling flight sink rate. These effects are further analyzed for their influence on the transient compensation of NETTO variometers as well as the speed ring. Some other disturbances due to the quality of sailplane preparation and flight dynamics are listed. Conclusions are drawn about the problems to pilots from imperfect NETTO variometer compensation and its effect on the maximization of ground speed from the speed ring. A modification for improvements to the speed ring and computer is suggested. Author

N79-23902*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE APPLICATION OF MICROPROCESSOR TECHNOLOGY TO IN-FLIGHT COMPUTATION **c60**
Patricia L. Sawyer and Dan M. Somers *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 267-284 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 09B

A modular design of a general purpose microprocessor-based computer to perform in-flight computations for cross-country soaring pilots is described. The basic requirements for the system are discussed. Several specialized applications of the computer are presented, including real-time pilot feedback and flight-test data acquisition and reduction. S.E.S.

N79-23903*# Massachusetts Inst. of Tech., Cambridge.
DESIGN OF PROPELLERS FOR MOTORSOARERS **c07**
E. Eugene Larrabee *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 285-303 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

A method was developed for the design of propellers of minimum induced loss matched to an arbitrary operating point characterized by disc loading (thrust or power), air density, shaft speed, flight speed, and number of blades. A consistent procedure is outlined to predict the performance of these propellers under off design conditions, or to predict the performance of propellers of general geometry. The examples discussed include a man powered airplane, a hang glider with a 7.5 kW (10 hp) 8,000 rpm engine, and an airplane-like motorsoarer. S.E.S.

N79-23904# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
DEVELOPMENT OF AN AIRBORNE MILITARY SYSTEM (MRCA SYSTEM) [ENTWICKLUNG EINES FLIEGENDEN WAFFENSYSTEMS AM BEISPIEL MRCA]
Helmut Langfelder Feb. 1977 19 p refs In GERMAN (MBB-UFE-1322-O) Avail: NTIS HC A02/MF A01

The problems (technical, economic, political, and financial) encountered when launching a new program for the construction of a series of military aircraft are discussed. The background to the 1969 options taken for MRCA Tornado are presented. Two groups are involved: PANAVIA (MBB: 42.5 percent, German; BAC: 42.5 percent, British; FIAT: 15 percent, Italian) and NAMMA (NATO MRC Agency), the former executing the program and the latter ordering; 25,000 persons employed by 350 companies currently participate in this program in the three countries concerned. This figure will increase to 70,000 persons by the end of the decade and involve some 800 aircraft costing 8 billion DM. The program has thus so far been successful.
Author (ESA)

N79-24940# Joint Publications Research Service, Arlington, Va.
APPLICATION OF ELECTRON-BEAM WELDING TO AVIATION PRODUCTION
Henryk Zatyka *In its* Transl. on Eastern Europe: Sci. Affairs, No. 625 (JPRS-73266) 20 Apr. 1979 p 22-36 refs Transl. into ENGLISH from Tekhn. Lotniczna i Astronautyczna (Warsaw), no. 1, Jan. 1979 p 29-33 (For primary document see N79-24938 15-99)
Avail: NTIS HC A03/MF A01

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-23905 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL NON-STEADY MEAN NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS PAST ARBITRARY SHAPED BODIES Ph.D. Thesis
Bruce Bailey Amlicke 1978 97 p
Avail: Univ. Microfilms Order No. 7909328

The numerical solution to the implicit finite difference equations approximation to the modeled equations was solved by a point successive overrelaxation technique. Boundary conditions on the vorticity density equation were made more manageable for a computer solution by introducing surface roughness. The surface boundary condition on vorticity was determined by an iterative sequence relating calculated surface velocity to predicted surface vorticity. A solution is presented for the flow around a circular cylinder at a Reynolds number of 1.4 million. The solution was started from rest and carried to a time of 3.72 based on the body moving one radius in a unit of time. Dissert. Abstr.

N79-23906 Cornell Univ., Ithaca, N. Y.
NUMERICAL CALCULATION OF INVISCID TRANSONIC FLOW THROUGH ROTORS AND FANS Ph.D. Thesis
Djordje Stevo Dulikravich 1979 249 p
Avail: Univ. Microfilms Order No. 7910741

Steady, transonic, inviscid, potential, lifting flows through two dimensional stationary air-foil cascades and three dimensional, rotating cascades mounted on a doubly infinite cylindrical hub were analyzed. The exact full potential equation was derived in its canonical form with appropriate boundary and periodicity conditions for these cases. Two separate computer programs were developed that numerically solve that equation, allowing for arbitrary airfoil shapes and blade taper, sweep, dihedral and twist distribution as well as for the occurrence of the weak shocks. The computational domain was formed using a sequence of geometric transformations of the physical domain providing the boundary fitted corrdinate system. These algorithms can serve for the flow prediction about isolated propellers, hovering rotors, wind turbines, ducted fans, stators and finned missiles.
Dissert. Abstr.

N79-23907 Tennessee Univ., Knoxville.
AN EXPERIMENTAL STUDY OF TRANSONIC TURBULENT FLOW SEPARATION Ph.D. Thesis
Ahmad Vakili-Dastjerd 1978 183 p
Avail: Univ. Microfilms Order No. 7911721

The main purpose of this study was to investigate transonic flow scaling effect and gain basic understanding of disturbed boundary layer separation at transonic speeds. Simple geometrical surface and flow discontinuities of different sizes were selected to cause upstream disturbances and/or generate downstream adverse pressure gradient regions strong enough to produce local flow separation. The incipient separation angle in flow over ramp compression corner was measured. An average incipient separation angle of 22.5 degrees was confirmed, with no Reynolds number effect in the above range of free stream flow parameters. It was observed that an upstream disturbance under certain conditions causes an increased incipient separation angle. Extensive wall static pressure measurements were performed.
Dissert. Abstr.

N79-23908*# National Aeronautics and Space Administration, Washington, D. C.
AERODYNAMICS
N. F. Krasnov 1978 758 p refs Transl. into ENGLISH of the book "Aerodinamika" Moscow, Vysshaya Shkola Publishers, 1971 Sponsored by NASA and NSF Transl. by Amerind Pub. Co. pvt. Ltd., New Delhi
(NASA-TT-F-765; TT74-52006) Avail: NTIS HC A99/MF A01 CSCL 01A

The applications of aerodynamics particularly in rocket technology and modern high-speed aviation are studied along with the general laws of motion of a gas medium. The first six chapters of the book cover the following: basic concepts and definition of aerodynamics, kinematics of a fluid medium, equations of motion of a gas in the general case (where variations in its physico-chemical properties are considered), the theory of shock waves, the method of characteristics (very widely used in the investigation of supersonic flows), and the general theory of the motion of a gas in two-dimensional space. The practical applications or connections with the formulation of methods of aerodynamic calculations for flight vehicles and their individual elements are shown. G.Y.

N79-23909*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN IMPLICIT ALGORITHM FOR THE CONSERVATIVE, TRANSONIC FULL-POTENTIAL EQUATION WITH EFFECTIVE ROTATED DIFFERENCING

Terry L. Holst and John Albert (Santa Clara Univ., Calif.) Apr. 1979 37 p refs

(Contract NCA2-OR-685-803)

(NASA-TM-78570) Avail: NTIS HC A03/MF A01 CSCL 01A

A new differencing scheme for the conservative full potential equation which effectively simulates rotated differencing is presented. The scheme was implemented by an appropriate upwind bias of the density coefficient along coordinate directions. A fast, fully implicit, approximate factorization iteration scheme was then used to solve the resulting difference equations. Solutions for a number of traditionally difficult transonic airfoil test cases are presented. J.A.M.

N79-23910*# National Aeronautics and Space Administration, Washington, D. C.

APPROXIMATION THEORY FOR BOUNDARY LAYER SUCTION THROUGH INDIVIDUAL SLITS

A. Walz May 1979 51 p refs Transl. into ENGLISH of "Naherungstheorie fuer Grenzschichtabsaugung durch Einzelschiltze", Rept. DVL-184 DFVLR, Inst. fuer Angew. Mat. und Mech., Freiburg, Jun. 1972 47 p Translation was announced as N62-16345 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75384; DVL-184) Avail: NTIS HC A04/MF A01 CSCL 01A

The basic concepts of influencing boundary layers are summarized, especially the prevention of flow detachment and the reduction of frictional resistance. A mathematical analysis of suction through a slit is presented with two parameters, for thickness and for shape of the boundary layer, being introduced to specify the flow's velocity profile behind the slit. An approximation of the shape parameter produces a useful formula, which can be used to determine the most favorable position of the slit. An aerodynamic example is given. Author

N79-23911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORETICAL FAN VELOCITY DISTORTIONS DUE TO INLETS AND NOZZLES

J. Dennis Hawk 1979 12 p refs Presented at the Workshop on V/STOL Aerodyn., Monterey, Calif., 16-18 May 1979

(NASA-TM-79150; E-[illegible]6) Avail: NTIS HC A02/MF A01 CSCL 01A

Nonuniform velocity profiles imposed on the propulsion system fan can cause fan blade stresses and thrust losses. A theoretical parametric study of the effects of inlets with 0 deg and 90 deg nozzle deflection on the velocity profile at a hypothetical fan is presented. The parameters investigated are fan-to-nozzle spacing and inlet centerline offset. The interaction between the inlet and nozzle is also investigated. The study is made using a two-dimensional analysis. A.R.H.

N79-23912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIRCRAFT ICING

Bernard J. Blaha, comp. 1979 147 p refs Workshop held at Cleveland, 19-21 Jul. 1978

(NASA-CP-2086; FAA-RD-78-109; E-027) Avail: NTIS HC A07/MF A01 CSCL 01C

The results of a conference on the problems of aircraft icing are reported. For individual titles, see N79-23913 through N79-23919.

N79-23913*# National Aeronautics and Space Administration, Washington, D. C.

AIRCRAFT ICING: INTRODUCTION c02

John H. Enders *In* NASA. Lewis Res. Center Aircraft Icing 1979 3 p (For primary document see N79-23912 15-07)

Avail: NTIS HC A07/MF A01 CSCL 01C

The objectives of the Workshop were as follows: (1) to assess the current understanding of fixed wing and rotorcraft operational icing environments and problems (2) to evaluate facilities requirements for R&D and certification purposes (3) to examine means of improving icing forecasts (4) to identify shortcomings in aeronautical icing knowledge which can be alleviated by new research and instrumentation development. L.S.

N79-23914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXECUTIVE SUMMARY OF AIRCRAFT ICING SPECIALISTS WORKSHOP

Milton A. Beheim *In its* Aircraft Icing 1979 p 1-16 (For primary document see N79-23912 15-02)

Avail: NTIS HC A07/MF A01 CSCL 01C

In a period of escalating development costs for new aircraft, there is growing interest in a renewed and coordinated icing research effort to achieve an updating or modernization of each aspect of the technological issues that are involved. This includes the data base, analysis methods, test techniques, and test facilities. L.S.

N79-23915*# Air Force Geophysics Lab., Hanscom AFB, Mass.

ICING OF AIRCRAFT SOME REMARKS WITH AN HISTORICAL SLANT FROM A CLOUD PHYSICIST

Robert M. Cunningham *In* NASA. Lewis Res. Center Aircraft Icing 1979 p 17-19 (For primary document see N79-23912 15-02)

Avail: NTIS HC A07/MF A01 CSCL 01C

Three areas of interest are commented on: cloud physics, nowcasting, and instrumentation. A comparison is made of what was done 30 years ago to what might be done in light of developments in related areas of cloud physics, weather modification and instrumentation. L.S.

N79-23916*# National Transportation Safety Board, Washington, D. C.

SAFETY HAZARD OF AIRCRAFT ICING

James C. McLean, Jr. *In* NASA. Lewis Res. Center Aircraft Icing 1979 p 21-27 (For primary document see N79-23912 15-02)

Avail: NTIS HC A07/MF A01 CSCL 01C

The problem of aircraft icing is reported as well as the type of aircraft affected, the pilots involved, and an identification of the areas where reduction in icing accidents are readily accomplished. M.M.M.

N79-23917*# RCA Flight Operations, Trenton, N. J.

CIVIL HELICOPTER ICING PROBLEMS

Peter B. Sweenkey *In* NASA. Lewis Res. Center Aircraft Icing 1979 p 29-30 (For primary document see N79-23912 15-02)

Avail: NTIS HC A07/MF A01 CSCL 01C

The ice capabilities of rotary wing aircraft are examined. Recommendations are given to improve the inadequacies of the weather forecasts pertaining to ice, and to adopt a low maintenance anti-ice system. M.M.M.

N79-23918*# Cessna Aircraft Co., Wichita, Kans.

A REVIEW OF THE ICING SITUATION FROM THE STANDPOINT OF GENERAL AVIATION

Dennis W. Newton *In* NASA. Lewis Res. Center Aircraft Icing 1979 p 31-38 refs (For primary document see N79-23912 15-02)

Avail: NTIS HC A07/MF A01 CSCL 01C

An overview of the present situation in the field of aircraft icing with respect to certification and operation of nontransport category airplanes is given. Problems of definition and inconsistencies are pointed out. Problems in the forecasting and measurement of icing intensities are discussed. The present regulatory environment is examined with respect to its applicability and appropriateness to nontransport airplanes. M.M.M.

N79-23919*# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.

OVERVIEW OF HELICOPTER ICE PROTECTION SYSTEM DEVELOPMENTS

Richard I. Adams *In* NASA. Lewis Res. Center Aircraft Icing 1979 p 39-65 refs (For primary document see N79-23912

15-02)
Avail: NTIS HC A07/MF A01 CSCL 01C

Helicopter ice protection design criteria was developed and technological shortcoming in meeting helicopter mission requirements is that of helicopter rotor blade ice protection. Airframe components are protected using existing technology while the rotor blade protected using the cyclic electrothermal deicing concept. M.M.M.

N79-23920*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL INVESTIGATION OF FORCED MIXING OF A TURBULENT BOUNDARY LAYER IN AN ANNULAR DIFFUSER Ph.D. Thesis - Ohio State Univ.
Robert Joseph Shaw Apr. 1979 182 p refs
(NASA-TM-79171; E-9947) Avail: NTIS HC A09/MF A01 CSCL 01A

The forced mixing process of a turbulent boundary layer in an axisymmetric annular diffuser using conventional wing-like vortex generators was studied. Flow field measurements were made at four axial locations downstream of the vortex generators. At each axial location, a total of 25 equally spaced profiles were measured behind three consecutive vortex generators which formed two pairs of vortex generators. Hot film anemometry probes measured the boundary layer turbulence structure at the same locations where pressure measurements were made. Both single and cross film probes were used. The diffuser turbulence data was teken only for a nominal inlet Mach number of 0.3. Three vortex generator configurations were tested. The differences between configurations involved changes in size and relative vortex generator positions. All three vortex generator configurations tested provided increases in diffuser performance. Distinct differences in the boundary layer integral properties and skin friction levels were noted between configurations. The axial turbulence intensity and Reynolds stress profiles measured displayed similarities in trends but differences in levels for the three configurations. A.R.H.

N79-23921*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF SUBSONIC WINGS Final Report
Fred R. DeJarnette and Neal T. Frink 11 Jun. 1979 148 p refs
(Grant NsG-1437)
(NASA-CR-158661) Avail: NTIS HC A07/MF A01 CSCL 01A

An analytical strake design procedure is investigated. A numerical solution to the governing strake design equation is used to generate a series of strakes which are tested in a water tunnel to study their vortex breakdown characteristics. The strakes are scaled for use on a half-scale model of the NASA-LaRC general research fuselage with a 44 degrees trapezoidal wing. An analytical solution to the governing design equation is obtained. The strake design procedure relates the potential-flow leading-edge suction and pressure distributions to vortex stability. Several suction distributions are studied and those which are more triangular and peak near the tip generate strakes that reach higher angles of attack before vortex breakdown occurs at the wing trailing edge. For the same suction distribution, a conical rather than three dimensional pressure specification results in a better strake shape as judged from its vortex breakdown characteristics. M.M.M.

N79-23922*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN INVESTIGATION OF A FULL-SCALE ROTOR WITH FOUR BLADE TIP PLANFORM SHAPES
Robert H. Stroub May 1979 72 p refs Sponsored in part by AVRADCOM
(NASA-TM-78580; AVRADCOM-TR-79-14; A-7793) Avail: NTIS HC A04/MF A01 CSCL 01A

A test of a full-scale helicopter rotor was conducted in the Ames Research Center 40- by 80-Foot Wind Tunnel to investigate performance loads and noise characteristics of rotors with various tip geometries. Four blade tip geometries were investigated; rectangular, trapezoidal, swept rectangular, and swept trapezoidal. The investigation was accomplished over an advance-ratio range of 0.2 to 0.375 and an advancing blade Mach number range of 0.72 to 0.97. The performance aspects are presented with power comparisons between tip shapes. On a power basis, the best overall tip shape was the swept-trapezoidal geometry. J.M.S.

N79-23923*# Vought Corp., Hampton, Va. Technical Center.
MINIMIZATION THEORY OF INDUCED DRAG SUBJECT TO CONSTRAINT CONDITIONS
John DeYoung Washington NASA Jun. 1979 126 p refs (Contract NAS1-13500)
(NASA-CR-3140) Avail: NTIS HC A07/MF A01 CSCL 01A

Exact analytical solutions in terms of induced drag influence coefficients can be attained which define the spanwise loading with minimized induced drag, subject to specified constraint conditions, for any nonplanar wing shape or number of lift plus wing bending moment about a given wing span station. Example applications of the theory are made to a biplane, a wing in ground effect, a cruciform wing, a V-wing, a planar-wing winglet, and linked wingtips in formation flying. For minimal induced drag, the spanwise loading, relative to elliptic, is outboard for the biplane and is inboard for the wing in ground effect and for the planar-wing winglet. A spinoff of the triplane solution provides mathematically exact equations for downwash and sidewash about a planar vorticity sheet having an arbitrary loading distribution. Author

N79-23924*# Old Dominion Univ., Norfolk, Va.
NUMERICAL OPTIMIZATION TECHNIQUES FOR BOUND CIRCULATION DISTRIBUTION FOR MINIMUM INDUCED DRAG OF NONPLANAR WINGS: BASIC FORMULATIONS Final Report
John Kuhlman Jun. 1979 47 p refs
(Grant NsG-1357)
(NASA-CR-3154) Avail: NTIS HC A03/MF A01 CSCL 01A

A theoretical method was developed for determining the optimum span load distribution for minimum induced drag for subsonic nonplanar configurations. The undistorted wing wake is assumed to have piecewise linear variation of shed vortex sheet strength, resulting in a quadratic variation of bound circulation and span load. The optimum loading is obtained either through a direct technique, whereby derivatives of the drag expression are calculated analytically in terms of the unknown wake vortex sheet strengths. Both techniques agree well with each other and with available exact solutions for minimum induced drag. Author

N79-23925# Committee on Commerce, Science, and Transportation (U. S. Senate).
PROPELLED LIGHTER-THAN-AIR VEHICLES
Washington GPO 1979 157 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci. and Transportation, 96th Congr., 1st Sess., 27 Feb., 1 Mar. 1979
(GPO-43-457) Avail: Subcomm. on Sci., Technol., and Space

Testimony is presented dealing with potential uses for lighter than air vehicles. These include the transportation and emplacement of very heavy assemblies and subassemblies encountered in the construction industry, particularly within developing areas where surface tractors, roads, bridges, etc. are lacking, and long-endurance surveillance, i.e., patrolling the recent extension of the national fisheries rights to the 200 mile offshore zone. J.M.S.

N79-23926# Avco Systems Div., Wilmington, Mass.
HYPERSONIC HEAT TRANSFER TEST PROGRAM IN THE VKI LONGSHOT FACILITY Final Report, 1 Dec. 1977 - 30 Nov. 1978
V. Dicristina Jan. 1979 32 p
(Contract F49620-78-C-0029; AF Proj. 2307)
(AD-A065645; AVSD-0028-79-CR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A series of tests was performed in the Longshot Facility of the Von Karman Institute for Fluid Dynamics (VKI) in Rhode-St. Genese, Belgium. This post test report is a summary of 16 tests conducted in the Longshot Facility during the periods of 5-16 June 1978 (Phase 1) and 18-29 September 1978 (Phase 2). The complete test results are included in the VKI

post test report. The purpose of these tests was to measure local pressure and heat transfer distributions on a concave body configuration over a range of Mach number and Reynolds number conditions. Both small and large surface roughness body data were obtained at zero and three degrees angle of attack. High speed cine Schlieren Photographs of the model bow shock structure and dynamics were obtained. GRA

N79-23927# ARO, Inc., Arnold Air Force Station, Tenn.
ROLL-DAMPING DERIVATIVE CALCULATIONS FOR SPINNING SHARP AND BLUNT CONES IN SUPERSONIC AND HYPERSONIC FLOW Final Report, 1 Oct. 1977 - 31 Aug. 1978
Arloe W. Mayne, Jr. AEDC Feb. 1979 25 p refs Sponsored by the Air Force
(AD-A065594; AEDC-TR-78-64) Avail: NTIS HC A02/MF A01 CSCL 20/4

The boundary-layer equations in a Crocco variables form have been numerically solved for flow over spinning sharp and blunt cones at zero incidence to supersonic and hypersonic streams. Both laminar and turbulent flows have been treated, and for the blunt cases swallowing of the inviscid entropy layer by the boundary layer has been considered. The item of primary interest is roll damping, and results of a parametric study involving Mach number, Reynolds number, cone angle, and bluntness ratio are presented. Limited comparisons with experimental data and another method of computation are also presented.
Author (GRA)

N79-23928# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF THIN WING IN A SUPERSONIC FLOW WITH CONSIDERATION OF THE NON-EQUILIBRIUM STATE OF EXCITATION OF OSCILLATING DEGREES OF FREEDOM
Ye. P. Aksenov and Yu. N. Grigoryev 9 Nov. 1978 18 p refs Transl. into ENGLISH from Uch. Zap., Perm. Gos. Univ. (USSR), no. 156, 1966 18 p
(AD-A065992; FTD-ID(RS)T-1775-78) Avail: NTIS HC A02/MF A01 CSCL 20/4

The non equilibrium state in excitation of oscillating degrees of freedom was calculated. The problem of the steady state in the supersonic gas flow surrounding the wings were studied.
S.E.S.

N79-23929# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERSONIC FLOW IN THE AREA OF ANTISYMMETRIC THIN CRUCIFORM WINGS WITH SUPERSONIC LEADING EDGES IN A HORIZONTAL PLANE, WITH CONSIDERATION OF FLOW SEPARATION ON THE EDGES
Stefan Staic 30 Oct. 1978 19 p refs Transl. into ENGLISH from Bul. Inst. Politehnic (Romania), vol. 33, no. 1, 1971 p 103-118
(AD-A065993; FTD-ID(RS)T-1859-78) Avail: NTIS HC A02/MF A01 CSCL 20/4

The flow in the supersonic regime in the area of a thin cruciform wing antisymmetric distribution of incident angles was studied. A cruciform wing composed of two simple delta wings perpendicular to one another with Cartesion axes was designed.
S.E.S.

N79-23930# Prototype Development Associates, Inc., Santa Ana, Calif.
HARDENED RV DEVELOPMENT PROGRAM. PHASE 4: VEHICLE RECOVERY TECHNOLOGY WIND TUNNEL TESTS Final Report, 11 May 1976 - 31 Mar. 1977
D. H. Smith and L. S. Groener Aug. 1978 84 p refs
(Contract DNA001-76-C-0310)
(AD-A066095; AD-E300470; PDA-TR-1065-00-19; DNA-4656F) Avail: NTIS HC A05/MF A01 CSCL 20/4

A study of mass-jettison-drogue ICBM nosetip recovery vehicles was conducted, followed by wind tunnel tests of the configurations that appeared most attractive. Various combinations of vehicle and nosetip geometry were tested in AEDC tunnel A at Mach numbers from 3 to 5 and Reynolds numbers 2,000,000/ft to 4,000,000/ft. Heat transfer data was taken to assure that turbulent flow over the entire model was achieved; however, the primary goal of the tests was force data. Author (GRA)

N79-23931# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 6B: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SINGLE FILM DATA, BASIC CONFIGURATION WAKE EXPLORATIONS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Phillip F. Sheridan Sep. 1978 374 p Prepared for Army Res. and Technol. Labs., Fort Eustis, Va. 4 Vol.
(Contract DAAJ02-77-C-0020)
(AD-A061861; USARTL-TR-78-23F-Vol-6B) Avail: NTIS HC A16/MF A01 CSCL 01/3

Spectrograms of the six velocity measurements taken from the single film transducers are presented. The transducers were located outboard on the wake rake to the left and right of the split film transducers. These plots are machine plotted spectrograms in the one-third octave band format. J.M.S.

N79-23932# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 3A: FLOW ANGLE AND VELOCITY WAKE PROFILES IN LOW FREQUENCY BAND, BASIC INVESTIGATIONS AND HUB VARIATIONS Final Report, 15 Mar. 1977 - 13 Feb. 1978
Phillip F. Sheridan Sep. 1978 175 p Prepared for Army Res. and Technol. Labs., Fort Eustis, Va. 4 Vol.
(Contract DAAJ02-77-C-0020)
(AD-A061766; USARTL-TR-78-23C-Vol-3A) Avail: NTIS HC A08/MF A01 CSCL 01/3

Profiles of the RMS values of the wake flow angles and velocities in the 1 omega and 2 omega range are presented. The format is waterline on the ordinate and velocity or flow angle on the abscissa. Each graph shows a comparison of the baseline flow to the flow modified by some device or condition. Build-up to baseline, baseline wake exploration, and the effects of various hub caps are covered. J.M.S.

N79-23933# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 3B: FLOW ANGLE AND VELOCITY WAKE PROFILES IN LOW FREQUENCY BAND, AIR EJECTOR SYSTEMS AND OTHER DEVICES Final Report, 15 Mar. 1977 - 13 Feb. 1978
Phillip F. Sheridan Sep. 1978 203 p Prepared for Army Res. and Technol. Labs., Fort Eustis, Va. 4 Vol.
(Contract DAAJ02-77-C-0020)
(AD-A061767; USARTL-TR-78-23C-Vol-3B) Avail: NTIS HC A10/MF A01 CSCL 01/3

Profiles of the RMS values of the wake flow angles and velocities in the 1 omega and 2 omega range are presented. The format is waterline on the ordinate and velocity or flow angle on the abscissa. Each graph shows a comparison of the baseline flow to the flow modified by some device or condition. Air ejector systems, air ejectors and hub caps in the same configuration, wings, fairings, and miscellaneous devices are covered. J.M.S.

N79-23934# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 2B: HARMONIC ANALYSES OF AIRFRAME SURFACE PRESSURE DATA, RUNS 7 - 14, MIDSECTION Final Report, 15 Mar. 1977 - 13 Feb. 1978
Phillip F. Sheridan Sep. 1978 219 p Prepared for Army Res. and Technol. Labs., Fort Eustis, Va. 4 Vol.
(Contract DAAJ02-77-C-0020)
(AD-A061860; USARTL-TR-78-23B-Vol-2B) Avail: NTIS HC A10/MF A01 CSCL 01/3

Harmonic analyses of the waveforms generated by each of the 53 pressure transducers, which covered the surface of the model fuselage and empennage are presented. The analyses encompass the transducers in the middle section of the model. Test conditions and configurations include baseline data, climb and descent, disk loading variation, and application of strakes.
J.M.S.

N79-23935# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Unternehmungsbereich Flugzeuge- Entwicklung.
A FINITE ELEMENT METHOD FOR THE COMPUTATION

OF THE TRANSONIC POTENTIAL FLOW PAST AIRFOILS
Albrecht Eberle 23 Sep. 1977 63 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1352-O) Avail: NTIS HC A04/MF A01

A special finite element method for computing the transonic potential flow with shocks past airfoils is presented. The artificial viscosity concept is used for the local supersonic flow regime. Since, in general, classical elements do not meet the requirements of advanced numerical aerodynamics, particular attention was given to classing an appropriate element. The usefulness of the method is demonstrated by a series of computed pressure distributions. Author (ESA)

N79-23936# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
AERODYNAMIC PROBLEMS IN ENGINE AIRFRAME INTEGRATION ON FIGHTER AIRPLANES
Kurt Lotter 26 Sep. 1977 80 p refs In GERMAN; ENGLISH summary Presented at 85th Wehrtech. Symp. Luftfahrttechn. III Moderne Triebwerkstechnol., Mannheim, West Ger., 21-22 Sep. 1977
(MBB-UFE-1359-O) Avail: NTIS HC A05/MF A01

Different types of intake are discussed together with engine mass flow/air intake matching problems. Emphasis is given to intake/engine compatibility and instantaneous distortion measurements. The sources and consequences of intake malfunctions are illustrated; some typical supersonic fighter aircraft intakes are described. Nozzle concepts are presented and interference effects between propulsive jet and external flow are shown. The afterbody drag of fighter aircraft is given. Improvements with convergent/divergent nozzles are shown. Thrust reversal interference effects are mentioned. Future trends are presented. Author (ESA)

N79-23937# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
AIRFOIL OPTIMIZATION FOR TRANSONIC FLOW USING THE METHODS OF FINITE ELEMENTS AND CHARACTERISTICS
Albrecht Eberle 2 Nov. 1977 59 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1362-O) Avail: NTIS HC A04/MF A01

A simple method for the optimization of airfoilds was derived from the principle of the elliptic continuation in the supersonic flow regime. Contour deformations on arbitrary input airfoils are derived in such a way that the resulting supercritical flow is shockless. The subsonic flow field was computed by the method of finite elements. The supersonic problem was solved separately by the method of characteristics. Author (ESA)

N79-23938# Oxford Univ. (England). Engineering Lab.
MEASUREMENT OF THE DRAG OF SLENDER CONES IN HYPERSONIC FLOW AT LOW REYNOLDS NUMBERS USING A MAGNETIC SUSPENSION AND BALANCE
T. F. Haslam-Jones 1978 119 p refs
(Contract MIN-DEF/PE-AT/2057/042)
(OUEL-1235/78) Avail: NTIS HC A02/MF A01

In order to carry out a comprehensive experimental survey of aerodynamic force on slender axisymmetric bodies in rarefied hypersonic flow, an electromagnetic jig and balance was built for use with the Oxford University low density tunnel. The design of this apparatus was based on the magnetic jig for spheres built in the same laboratory. The drag force measurements on sharp cones are given for freestream Reynolds numbers, based on cone diameter, of 120 to 1200 at free stream Mach numbers between 5 and 9. These data were obtained by using a contoured nozzle and free jets. The results from the two types of flow devices overlapped and afforded direct comparisons between them. Comparisons are made with other experimental results and the general correlation of all relevant data is discussed. Author (ESA)

N79-23939# National Technical Information Service, Springfield, Va.
AIRCRAFT WAKE VORTICES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1979
Guy E. Habercom, Jr. Mar. 1979 266 p Supersedes NTIS/PS-78/0122, NTIS/PS-77/0067, NTIS/PS-76/0072 and NTIS/PS-75/164
(NTIS/PS-79/0166/3; NTIS/PS-78/0122; NTIS/PS-77/0067; NTIS/PS-76/0072; NTIS/PS-75/164) Avail: NTIS HC $28.00/MF $28.00 CSCL 01A

Wake vortices and turbulent flow across aircraft lifting surfaces were investigated in the Government-sponsored research. Aerodynamic characteristics of vortices were reviewed with special attention made to trailing aircraft and aviation safety. This updated bibliography contains 258 abstracts, 27 of which are new entries to the previous edition. GRA

N79-23890*# Boeing Commercial Airplane Co., Seattle, Wash.
LOW-SPEED SINGLE-ELEMENT AIRFOIL SYNTHESIS
John H. McMasters and Michael L. Henderson *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 1-31 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

N79-23891*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPLORATORY INVESTIGATION OF THE EFFECT OF PLASTIC COATING ON THE PROFILE DRAG OF A PRACTICAL-METAL-CONSTRUCTION SAILPLANE AIRFOIL
Dan M. Somers *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 33-64 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

N79-23893*# Stuttgart Univ. (West Germany).
THE EFFECT OF DISTURBANCE ON A WING
Richard Eppler *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 81-92 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

N79-23894*# Technische Univ., Berlin (West Germany).
GENERATION AND BREAKDOWN OF AERODYNAMIC LIFT: PHYSICAL MECHANISM
Wolfgang Liebe *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 93-102 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 02A

N79-23896*# Stuttgart Univ. (West Germany).
SOME NEW AIRFOILS
Richard Eppler *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 131-154 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

N79-23897*# Princeton Univ., N. J.
A COMPARISON OF THE AERODYNAMIC CHARACTERISTICS OF EIGHT SAILWING AIRFOIL SECTIONS
Mark D. Maughmer *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 155-176 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

N79-23898*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
LENGTH AND BURSTING OF SEPARATION BUBBLES: A PHYSICAL INTERPRETATION
John M. Russell *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 177-202 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-23940*# Boeing Commercial Airplane Co., Seattle, Wash.
INFLIGHT FUEL TANK TEMPERATURE SURVEY DATA Final Report
A. J. Pasion May 1979 60 p refs
(Contract NAS3-20815)
(NASA-CR-159569; D6-48611) Avail: NTIS HC A04/MF A01 CSCL 01C

Statistical summaries of the fuel and air temperature data for twelve different routes and for different aircraft models (B747, B707, DC-10 and DC-8), are given. The minimum fuel, total air and static air temperature expected for a 0.3% probability were summarized in table form. Minimum fuel temperature extremes agreed with calculated predictions and the minimum fuel temperature did not necessarily equal the minimum total air temperature even for extreme weather, long range flights. R.E.S.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-23941# Army Communications Command, Fort Huachuca, Ariz.
STANDARD ENGINEERING INSTALLATION PACKAGE. TERMINAL VHF OMNIDIRECTIONAL RANGE (TVOR) SYSTEM AN/FRN-41 Final Report
16 Feb. 1979 156 p
(AD-A065932; ACC-SEIP-012) Avail: NTIS HC A08/MF A01 CSCL 17/7

This Standard Engineering Installation Package(SEIP) provides information for the engineering and installation of TVOR facilities worldwide. Information provided consists of site survey data, siting criteria, installation specifications and instructions, a bill of materials, quality assurance procedures and completion certification format. Information provided must be adapted to the specific TVOR facility/location by the project engineer.
Author (GRA)

N79-23942# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
OPTICAL PATTERN RECOGNITION FOR TERMINAL GUIDANCE GUIDANCE
1978 10 p refs Repr. from SPIE, v. 133, 1978 p 51-57
(Grant AF-AFOSR-2851-75)
(AD-A062821; AFOSR-78-1605TR) Avail: NTIS HC A02/MF A01 CSCL 17/7

Recent advance in optical pattern recognition are described as they apply to terminal missile guidance. Practical recognition aspects are emphasized, specifically maintaining correlation in the presence of expected difference between the input and reference imagery. Author

N79-23943# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge- Entwicklung.
THE TIME BUDGET AS A CRITERION FOR THE WORKLOAD OF AIR TRAFFIC CONTROLLERS
Guenther Och 13 Sep. 1977 15 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1353-O) Avail: NTIS HC A02/MF A01

A time optimization method for evaluating the capacity of air traffic controllers is presented. As within a given time interval, only a limited number of minutes can be used for active control, the time consumption for the control of various flight phases was measured and used to calculate the number of flights which could be controlled during this interval. A capacity profile for the entire air space of the Federal Republic of Germany was constituted from characteristic traffic patterns obtained for each control sector. Author (ESA)

N79-23944# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
THE NAVSTAR GLOBAL POSITIONING SYSTEM: A PROGRAM WITH MANY UNCERTAINTIES
17 Jan. 1979 30 p
(PB-291438/0; PSAD-79-16) Avail: NTIS HC A03/MF A01 CSCL 17G

The Air Force is developing the NAVSTAR Global Positioning System for precise worldwide position and navigation capability. The current Department of Defense program cost estimate is $1.7 billion. However, this estimate does not include more than $2.5 billion in related systems costs and an undetermined amount for escalation costs. Defense is studying user needs, force effectiveness, replacement plans, and cost savings opportunities in preparation for a decision on whether to approve the program for full-scale engineering development. The GAO is concerned about the completeness and depth of coverage of the studies in view of the limited time remaining before the scheduled May 1979 review and subsequent decision by the Secretary of Defense. GRA

N79-23945# National Technical Information Service, Springfield, Va.
DISCRETE ADDRESS BEACON SYSTEM. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1979
William E. Reed Apr. 1979 149 p Supersedes NTIS/PS-78/0064; NTIS/PS-77/0035; NTIS/PS-76/0039
(NTIS/PS-79/0244/8; NTIS/PS-78/0064; NTIS/PS-77/0035; NTIS/PS-76/0039) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

The development of the discrete address beacon system is treated in these Federally-sponsored research reports. Topics include the data link, message formats, antenna systems, signal propagation, transponders, and interface with the air traffic control radar beacon system. This updated bibliography contains 140 abstracts, 27 of which are new entries to the previous edition.
GRA

N79-23946# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 27TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON THE V/STOL AIRCRAFT AT NIGHT AND IN POOR VISIBILITY
G. C. Howell (RAE, Bedford, Engl.) May 1979 13 p
(AGARD-AR-142; ISBN-92-835-1319-3) Avail: NTIS HC A02/MF A01

The desire of operators of all three services of the NATO nations to extend the use of helicopters and V/STOL aircraft into night and conditions of poor visibility has caused an expansion of activity in various technological fields, but most particularly in the electro-optical and radar sensors of various kinds. The integration of these new sensors into modern navigation, flight control and display systems is an important aspect - particularly in helicopters where space and weight are at a premium. Also, the pilot workload is already high in helicopters and V/STOL aircraft near the ground and any new technology must be introduced in a manner to keep the workload within bounds so as not to lose the benefits of the new sensors. Author

N79-24745*# Rockwell International Corp., Anaheim, Calif. Electronic Systems Group.
RUBIDIUM FREQUENCY STANDARD TEST PROGRAM FOR NAVSTAR GPS
Frank Koide and Darrell J. Dederich *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 379-392 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-23947# General Dynamics/Fort Worth, Tex.
ENERGY MANEUVERABILITY DISPLAY VALIDATION Final Report, May 1976 - Apr. 1978
A. H. Lusty, Jr., M. K. Fox, J. M. Norton, and R. J. Wenham Apr. 1978 121 p
(Contract F33615-76-C-3099)
(AFFDL-TR-78-35-Vol-1; AF Proj. 2403) Avail: NTIS HC A06/MF A01

Comparative testing of the F-16 aircraft energy maneuverability display (EMD) and a conventional display (CD) was performed in an F-16 simulation implemented on a large amplitude multimode aerospace research simulator. The test subjects (fighter pilots) performed two basic maneuvers with each display. Flight times were recorded for the turn and energy gain portions of each maneuver. These times were statistically compared, and engineering conclusions were made. Results of the simulation tests show that: (1) for the hard turn maneuver, the CD (with well-chosen rules-of-thumb) and the EMD are equally effective; (2) for the energy gain maneuver, the CD and the EMD are equally effective for the 'clean' configuration; however, for configurations with stores, the use of the EMD shows a significant advantage; and (3) for the combined sustained energy turn and energy gain maneuver, the EMD is more effective than the CD for all configurations tested. A.R.H.

N79-23948*# Hydraulic Research Textron, Valencia, Calif.
AN ELECTRIC CONTROL FOR AN ELECTROHYDRAULIC ACTIVE CONTROL AIRCRAFT LANDING GEAR Final Report
Irving Ross and Ralph Edson Apr. 1979 169 p refs
(Contract NAS1-14459)
(NASA-CR-3113) Avail: NTIS HC A08/MF A01 CSCL 01C

An electronic controller for an electrohydraulic active control aircraft landing gear was developed. Drop tests of a modified gear from a 2722 Kg (6000 lbm) class of airplane were conducted to illustrate controller performance. The results indicate that the active gear effects a force reduction, relative to that of the passive gear, from 9 to 31 percent depending on the aircraft sink speed and the static gear pressure. J.M.S.

N79-23949# Iowa Univ., Iowa City. Materials Engineering Div.
SUBSTRUCTURING METHODS FOR DESIGN SENSITIVITY ANALYSIS AND STRUCTURAL OPTIMIZATION Interim Technical Report, May - Aug. 1977
A. K. Govil, J. S. Arora, and E. J. Haug Aug. 1977 229 p refs
(Contracts DAAK11-77-C-0023; DAAA09-76-C-2013)
(AD-A065935; TR-34) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report presents an iterative method for optimal design of large scale structures that incorporates the concept of substructuring. Design sensitivity analysis for the method is developed in a state space setting, in which the symmetry of the structural stiffness matrix is utilized to define efficient adjoint calculations that yield explicit design derivatives. The entire procedure is then presented as a convenient computational algorithm. Applications of the method are given for optimal design of two and three dimensional truss, idealized wing, and framed structures. Computer programs based on the present algorithm are presented for three truss structures (10 member plane cantilever truss, 200 member plane truss, 63 member space truss), three idealized wing structures (18 element wing box beam, 39 element rectangular wing, 150 element swept wing), and three framed structures (one-bay two-story plane frame, two-bay six-story plane frame, 48 element space frame). Results obtained with the substructing formulation are compared first with results obtained without substructing and then with results obtained with other methods. GRA

N79-23950# Iowa Univ., Iowa City. Materials Engineering Div.
FAIL-SAFE OPTIMAL DESIGN OF STRUCTURES WITH SUBSTRUCTURING Interim Technical Report, May 1977 - Aug. 1978
D. T. Nguyen, A. K. Govil, J. S. Arora, and E. J. Haug Aug. 1978 188 p refs
(Contract DAAK11-77-C-0023)
(AD-A065936; TR-45) Avail: NTIS HC A09/MF A01 CSCL 01/3

The problem of fail-safe structural design is defined. An optimal design formulation for the problem is developed with substructuring. An optimal design algorithm based on the state space gradient projection method is derived. Optimal designs for several cases of an open and closed tail-boom structures for the Army Cobra helicopter are obtained and analyzed. Constraints are imposed on stresses, displacements, buckling, natural frequency and member sizes. A user's manual for a computer program based on the algorithm is also described. Author (GRA)

N79-23951# Kaman Avidyne, Burlington, Mass.
NOVA-2S, A STIFFENED PANEL EXTENSION OF THE NOVA-2 COMPUTER PROGRAM Final Report
Lawrence J. Mente and William N. Lee Kirtland AFB, N. Mex. Air Force Weapons Lab. Dec. 1978 153 p refs
(Contract F29601-78-C-0019)
(AD-A066038; AD-E200233; KA-TR-153; APNL-TR-78-182) Avail: NTIS HC A08/MF A01 CSCL 01/3

A stiffened panel extension is developed into the NOVA-2S and NOVA-2LTS computer programs which replace the NOVA-2 and NOVA-2LT programs for nuclear overpressure vulnerability and analysis of aircraft. These new versions are capable of analyzing a stiffened flat or cylindrical panel in both the elastic and inelastic response regions as well as retaining the capability of analyzing stiffeners and pure panels, individually. In the stiffened panel analysis the stiffeners are treated discretely in either or both coordinate directions and are allowed various eccentric positions relative to the single-layered, multilayered and honeycomb panel skin configurations. The stiffened panel analysis is evaluated successfully by comparing the analytical solutions with experimental results from 3 test programs that measured strains and displacement responses on stiffened panels. An evaluation of the stiffened panel analysis versus the approach of analyzing individual elements of the stiffened panel is made by comparing the two approaches on the basis of response quantities at constant range and slant ranges at constant damage level. Three stiffened panels that are very similar to those found on the B-52 aircraft were used and it was concluded that, in general, the individual element approach is not adequate and the stiffened panel analysis should be used for these types of stiffened panels. GRA

N79-23952# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PRODUCTION FUNCTION AND AIRFRAME COST ESTIMATION M.S. Thesis
John A. Long Dec. 1978 75 p refs
(AD-A065570; AFIT/GOR/SM/78D-8) Avail: NTIS HC A04/MF A01 CSCL 14/1

In recent years, men and governments have become keenly aware of the huge capital outlays necessary in the acquiring of new weapons systems. Increased burden on limited capital has required more complete and careful planning. This planning has led to the need for accurate and timely cost predictions of new systems. Historically, the variables affecting the future cost of aircraft airframes have been proven to be airframe weight and aircraft speed. These are often combined with learning hypothesis to form an airframe cost model. In this paper, the production function of microeconomics is combined with weight, speed, and learning to form a nonlinear cost estimation model. Nonlinear least squares regression analysis was used in evaluating this model. Although the results are inconclusive, based on the data used, weight and speed combined with learning still appear to be the best predictors of aircraft airframe cost. Author (GRA)

N79-23953# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A METHODOLOGY FOR AN EFFECTIVENESS ANALYSIS OF RPV'S IN A CHAFF DISPENSING ROLE M.S. Thesis

Robert W. Neumann Sep. 1977 129 p refs
(AD-A065557; AFIT/GSM/SM/77S-12) Avail: NTIS HC A07/MF A01 CSCL 17/4

The United States Air Force will possess the capability to employ several different remotely piloted vehicles (RPV's) for the conduct of chaff dispensing operations in the 1980's. An effectiveness analysis comparing force structure alternatives will provide information for decisions regarding RPV force mixes for that time frame. A model which can be used to evaluate the effectiveness of various kinds of RPV's in the performance of chaff dispensing missions is developed in this thesis. Based on the two vehicle operating parameters expected to differ significantly among the kinds of vehicles, navigational accuracy and reliability, the model combines analytical and digital computer simulation techniques to predict the number of vehicles required to successfully complete a chaff corridor saturation mission. The methodology developed in this thesis can aid the RPV System Program Office in performing effectiveness analyses comparing existing systems. In addition, with modification of the simulation portion of the model, the methodology can be used to analyze the effectiveness of RPV chaff mission employment options and to evaluate the benefits derived from modifications to the existing weapon systems. Author (GRA)

N79-23954# Vought Astronautics, Dallas, Tex.
VOLAR: A DIGITAL COMPUTER PROGRAM FOR SIMULATING VSTOL AIRCRAFT LAUNCH AND RECOVERY FROM SMALL SHIPS. VOLUME 1: PROGRAM DESCRIPTION Final Report
Julian Wolkovitch and Billy B. Brassell Dec. 1978 124 p refs
(Contract N62269-77-R-0389)
(AD-A066172; Rept-2-32000/8R-41672-Vol-1; NADC-77123-30-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01/2

A digital computer program has been developed for simulating the launch and recovery of VSTOL aircraft operating from small ships. Volume 1 of this report describes the program, Volume 2 is the user's manual. The program, known as VOLAR (Vought Launch and Recovery Dynamics Program), employs the computational technique of nonlinear covariance propagation. This permits the time histories of the means and variances of all systems state variables to be computed from a single run, as opposed to the Monte Carlo technique, which requires multiple runs, plus subsequent averaging. Typically, VOLAR requires approximately 7 percent of the computer time required for comparable Monte Carlo simulations. The program includes a general airframe mathematical model suitable for helicopters or fixed-wing aircraft. The airwake of a small ship is also modeled and ship motion models are included. Two alternative models of the human pilot are supplied, one is based on verbal adjustment rules, the other is based on optimal control theory, utilizing performance index parameters deduced from manned simulator experiments. The program is demonstrated for AV-8A recovery on a small ship. The trends predicted by VOLAR are shown to agree with flight test data. Author (GRA)

N79-23955# Vought Astronautics, Dallas, Tex.
VOLAR: A DIGITAL COMPUTER PROGRAM FOR SIMULATING VSTOL AIRCRAFT LAUNCH AND RECOVER FROM SMALL SHIPS. VOLUME 2: APPENDICES Final Report
Julian Wolkovitch and Billy B. Brassell Dec. 1978 338 p refs
(Contract N62269-77-R-0389)
(AD-A066173; Rept-2-32000/8R-51672-Vol-2; NADC-77123-30-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 01/2

Partial Contents: User's Manual; Listing for Classical Pilot Model; Listing for Optimal Controller Pilot Model; Describing Functions of General Single-Valued Nonlinearities Representable by Straight-Line Segments; and The I and R Arrays. GRA

N79-23956# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
PREDICTION OF THE ANGULAR RESPONSE POWER SPECTRAL DENSITY OF AIRCRAFT STRUCTURES Final Report, Jan. 1976 - Jun. 1978
Jon H. Lee, Michael Obal, W., and Dansen L. Brown Dec. 1978 98 p refs
(AD-A066141; AFFDL-TR-78-188) Avail: NTIS HC A05/MF A01 CSCL 01/3

The design of airborne electro-optical systems requires the knowledge of angular vibration as well as linear vibration of aircraft structures. Rather than predicting the angular vibration subject to aerodynamic and acoustic excitations, an attempt is made here to relate the angular vibration directly to the linear vibration response. With the Bernoulli-Euler beam used as a theoretical model, a relationship has been derived between the linear and angular vibration power spectral density functions. Based on this relationship together with the angular root-mean-squared vibration amplitude as previously predicted by Lee and Whaley (AFFDL-TR-76-56, AF Flight Dynamcs Laboratory, Wright-Patterson AFB, Ohio), it is now possible to predict the angular power spectral density and a length scale associated with the angular measurement technique. Tested on the typical flight test data of RF-4C and F-15 fighters, CH-3E helicopter, and B-52 bomber, the predicted angular power spectral density lies within a + or - 0 db band about the measurement. Though crude, such a prediction is useful in the preliminary design stage in that one can quickly estimate the angular vibration environment prior to fabrication. Author (GRA)

N79-23957# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 26TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON THE IMPACT OF INTEGRATED GUIDANCE AND CONTROL TECHNOLOGY ON WEAPONS SYSTEMS DESIGN
Morris A. Ostgaard Mar. 1979 13 p refs Symp. held in Sandefjord, Norway, 9-12 May 1978
(AGARD-AR-140; ISBN-92-835-1317-7) Avail: NTIS HC A02/MF A01

The significant conclusions and recommendations resulting from the technical evaluation are (1) there appears to be heavy reliance on well-defined requirements and operational concepts before technology innovations are stimulated; (2) technology will support increased functional integration and standardization for interoperability as evidenced by the use of a common Kalman filter for several positioning systems and multiple use of the horizontal station display for both command and control and map display purposes; (3) mission tailored control laws properly supported by mission display information can reduce pilot workload; (4) missile systems are critically dependent upon positioning systems and functional integration to satisfy critical performance cost, weight, and volume constraints; and (5) multiple use of common sensors, particularly for control and positioning, were shown to be technically practical. Author

N79-23892*# Technische Hochschule, Darmstadt (West Germany).
OPTIMUM TAIL PLANE DESIGN FOR SAILPLANES
Kay Mayland *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 65-80 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

N79-23899*# Rensselaer Polytechnic Inst., Troy, N. Y.
WING SHAPE OPTIMIZATION FOR MAXIMUM CROSS-COUNTRY SPEED, WITH MATHEMATICAL PROGRAMMING
Gunter Helwig *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 203-218 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-23958# Analytic Sciences Corp., Reading, Mass.
AVIONICS STANDARDIZATION POTENTIAL ANALYSIS

Final Report, 16 May 1977 - 16 May 1978
Robert K. Gates and Robert F. Shipp 30 Nov. 1978 89 p refs
(Contract F33615-77-C-1167; AF Proj. 2003)
(AD-A066138; TASC-TR-1059-3; AFAL-TR-78-168) Avail: NTIS HC A05/MF A01 CSCL 09/3

The objective of the Avionics Standardization Potential Analysis program is to develop a general methodology for evaluating the benefits accruing from the use of standard equipment across future USAF avionics systems. The methodology has been developed using navigation avionics, as being representative of avionics in general, in a study of standardization potential across navigation systems (SPANS). The methodology covers the process of establishing future avionics systems requirements through mission analysis, identification of available equipment for the design of mission-responsive avionics suites, evaluation of future quantitative demands for avionics equipment, synthesis of mission-capable avionics systems, collection of relevant cost and reliability data and evaluation of standardization options using a computer-based Standardization Evaluation Program (STEP). GRA

N79-23959# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 1: AVIONICS APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - 1977
Brian Carrigan Apr. 1979 210 p
(NTIS/PS-79/0312/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Studies of computer hardware and supporting software for aircraft applications are cited. The bibliography includes research on onboard data processing equipment, as well as navigation and guidance computers. This updated bibliography contains 203 abstracts, none of which is new to the previous edition. GRA

N79-23960# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 1: AVIONICS APPLICATIONS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Mar. 1979
Brian Carrigan Apr. 1979 97 p Supersedes NTIS/PS-78/0289; NTIS/PS-77/0126; NTIS/PS-76/0042
(NTIS/PS-79/0313/1; NTIS/PS-78/0289; NTIS/PS-77/0126; NTIS/PS-76/0042) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Equipment and computer programs for onboard data processing in support of aircraft guidance, flight control, and air navigation are described in reports cited in this updated bibliography which contains 91 abstracts, all of which are new to the previous edition. GRA

N79-23961# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 2: SPACE AND GUIDED MISSILE APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - 1977
Brian Carrigan Apr. 1979 264 p
(NTIS/PS-79/0314/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Onboard data processing equipment telemetering data processing, and navigation and guidance computers for both spacecraft and guided missiles are covered in this updated bibliography which contains 257 abstracts, none of which is new to the previous edition. GRA

N79-23962# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS. PART 2: SPACE AND GUIDED MISSILE APPLICATIONS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Mar. 1979
Brian Carrigan Apr. 1979 115 p Supersedes NTIS/PS-78/0290; NTIS/PS-77/0224; NTIS/PS-76/0043
(NTIS/PS-79/0315/6; NTIS/PS-78/0290; NTIS/PS-77/0224; NTIS/PS-76/0043) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Research reports on onboard data processing equipment, telemetering data processing, and navigation and guidance computers for spacecraft and guided missiles are cited in this updated bibliography which contains 108 abstracts, all of which are new entries to the previous edition. GRA

N79-23901*# Soaring Society of America, Los Angeles, Calif.
HOW ACCURATE IS NETTO
Stephen duPont *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 247-266 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 01D

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-23963*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBINED PRESSURE AND TEMPERATURE DISTORTION EFFECTS ON INTERNAL FLOW OF A TURBOFAN ENGINE
W. M. Braithwaite and Ronald H. Soeder 1979 19 p refs Presented at the 15th Joint Propulsion Conf., Las Vegas, 18-20 Jun. 1979; cosponsored by AIAA, the Soc. of Automotive Engr., and ASME
(NASA-TM-79136; E-9984) Avail: NTIS HC A02/MF A01 CSCL 21E

An additional data base for improving and verifying a computer simulation developed by an engine manufacturer was obtained. The multisegment parallel compressor simulation was designed to predict the effects of steady-state circumferential inlet total-pressure and total-temperature distortions on the flows into and through a turbofan compression system. It also predicts the degree of distortion that will result in surge of the compressor. The effect of combined 180 deg square-wave distortion patterns of total pressure and total temperature in various relative positions is reported. The observed effects of the combined distortion on a unitary bypass ratio turbofan engine are presented in terms of total and static pressure profiles and total temperature profiles at stations ahead of the inlet guide vanes as well as through the fan-compressor system. These observed profiles are compared with those predicted by the complex multisegment model. The effects of relative position of the two components comprising the combined distortion on the degree resulting in surge are discussed. Certain relative positions required less combined distortion than either a temperature or pressure distortion by itself. S.E.S.

N79-23964*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LEAN, PREMIXED, PREVAPORIZED COMBUSTION FOR AIRCRAFT GAS TURBINE ENGINES
Edward J. Mularz 1979 18 p refs Presented at the 15th Propulsion Conf., Las Vegas, 18-20 Jun. 1979; cosponsored by AIAA, the Soc. of Automotive Eng., and ASME Prepared in cooperation with Army Aviation Res. and Develop. Command, St. Louis, Mo.
(NASA-TM-79148; E-004; AVRADCOM-TR-79-18) Avail: NTIS HC A02/MF A01 CSCL 21E

The application of lean, premixed, prevaporized combustion to aircraft turbine engine systems can result in benefits in terms of superior combustion performanace, improved combustor and turbine durability, and environmentally acceptable pollutant emissions. Lean, premixed prevaporized combustion is particularly attractive for reducing the oxides of nitrogen emissions during high altitude cruise. The NASA stratospheric cruise emission reduction program will evolve and demonstrate lean, premixed, prevaporized combustion technology for aircraft engines. This multiphased program is described. In addition, the various elements

of the fundamental studies phase of the program are reviewed, and results to date of many of these studies are summarized.
Author

N79-23965*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DEGREE OF FUEL VAPORIZATION UPON EMISSIONS FOR A PREMIXED PREVAPORIZED COMBUSTION SYSTEM
L. P. Cooper 1979 17 p refs Presented at the 15th Joint Propulsion Conf. Las Vegas, 18-20 Jun. 1979; cosponsored by AIAA, SAE and ASME
(NASA-TM-79154; E-010) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental and analytical study of the combustion of partially vaporized fuel/air mixtures was performed to assess the impact of the degree of fuel vaporization upon emissions for a premixing-prevaporizing flametube combustor. Data collected show near linear increases in nitrogen oxide emissions with decreasing vaporization at equivalence ratios of 0.6. For equivalence ratio of 0.72, the degree of vaporization had very little impact on nitrogen oxide emissions. A simple mechanism which accounts for the combustion of liquid droplets in partially vaporized mixtures was found to agree with the measured results with fair accuracy with respect to both trends and magnitudes.
Author

N79-23966*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SHOCKS ON FILM COOLING OF A FULL SCALE TURBOJET EXHAUST NOZZLE HAVING AN EXTERNAL EXPANSION SURFACE
David M. Straight 1979 20 p refs Presented at the 15th Joint Propulsion Conf., Las Vegas, 18-20 Jun. 1979; cosponsored by AIAA, SAE, and ASME
(NASA-TM-79157; E-013) Avail: NTIS HC A02/MF A01 CSCL 21E

Experimental film cooling data obtained during exploratory testing with an axisymmetric plug nozzle having external expansion and installed on an afterburning turbojet engine in an altitude test facility is presented. The shocks and local hot gas stream conditions had a marked effect on film cooling effectiveness. An existing film cooling correlation was adequate at some operating conditions but inadequate at other conditions such as in separated flow regions resulting from shock boundary layer interactions.
R.E.S.

N79-23967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TWO-STAGE FAN WITH LARGER DAMPERS ON FIRST-STAGE ROTOR
Donald C. Urasek, Walter S. Cunnan, and William Stevans May 1979 81 p refs
(NASA-TP-1399; E-8958) Avail: NTIS HC A05/MF A01 CSCL 21E

The performance of a two stage, high pressure-ratio fan, having large, part-span vibration dampers on the first stage rotor is presented and compared with an identical aerodynamically designed fan having smaller dampers. Comparisons of the data for the two damper configurations show that with increased damper size: (1) very high losses in the damper region reduced overall efficiency of first stage rotor by approximately 3 points, (2) the overall performance of each blade row, downstream of the damper was not significantly altered, although appreciable differences in the radial distributions of various performance parameters were noted, and (3) the lower performance of the first stage rotor decreased the overall fan efficiency more than 1 percentage point.
Author

N79-23968*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF STEADY-STATE PRESSURE DISTORTION ON THE STALL MARGIN OF A J85-21 TURBOJET ENGINE
George A. Bobula Mar. 1979 28 p refs Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, St. Louis, Mo.
(NASA-TM-79123; E-9958; AVRADCOM-TR-79-12) Avail: NTIS HC A03/MF A01 CSCL 21E

The effects of the inlet pressure distortions, induced by five screen patterns, on the performance of a J85-21 turbojet engine was conducted at the NASA Lewis Research Center. Testing was in support of the HiMAT RPRV program at Dryden Flight Research Center. Distortion patterns were chosen based on anticipated application of test results of the HiMAT installation. Tests were conducted at a simulated Mach number and altitude condition of 0.9 and 10 973 meters. Results are presented in terms of distortion levels and standard compressor performance parameters.
Author

N79-23969*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF STEADY-STATE PRESSURE DISTORTION ON FLOW CHARACTERISTICS ENTERING A TURBOFAN ENGINE
Ronald H. Soeder and George A. Bobula Apr. 1979 34 p refs Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-79134; E-9982; AVRADCOM-TR-79-19) Avail: NTIS HC A03/MF A01 CSCL 21E

Flow angle, static-pressure, and total-pressure distributions were measured in the passage ahead of a turbofan engine operating with inlet pressure distortion. Distortions were generated with five screen configurations and one solid plate configuration. The screens and solid plate were circumferential and mounted on a rotatable assembly. Reynolds Number Index upstream of the distortion device was maintained at 0.5, 0.35, or 0.2, and engine corrected low-rotor speeds were held at 6000 rpm and 8600 rpm. Near the engine inlet, flow angle was largest at the hub and increased as flow approached the engine. The magnitude of static-pressure distortion measured along the inlet-duct and extended bullet nose walls increased exponentially as the flow approached the engine. Wall static-pressure distortion was also a function of distortion harmonic.
Author

N79-23970*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
FABRICATION OF J79 BORON/ALUMINUM COMPRESSOR BLADES Final Report, Apr. 1975 - Jun. 1978
J. W. Brantley and R. G. Stabrylla May 1979 74 p refs
(Contract NAS3-18943)
(NASA-CR-159566; R79AEG388) Avail: NTIS HC A04/MF A01 CSCL 21E

A total of 81 boron/aluminum first stage compressor blades were developed. The processing of the blades and the series designs established for various types of blade tests are described.
S.E.S.

N79-23971*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRCRAFT ENGINE NOZZLE Patent Application
Norman E. Sorensen and Eldon A. Latham, inventors (to NASA) Filed 23 Mar. 1979 14 p
(NASA-Case-ARC-10977-1; US-Patent-Appl-SN-023436) Avail: NTIS HC A02/MF A01 CSCL 21E

A variable area exit nozzle arrangement for an aircraft engine having a substantially reduced length and weight is described. It comprises longitudinally movable radial vanes and fixed radial vanes. The movable radial vanes are alternately disposed with respect to the fixed radial vanes. Means for displacing the movable radial vanes along the longitudinal axis of the engine relative to the fixed radial vanes are determined. The fixed radial vanes radially extend across the main exhaust flow of the engine.
NASA

N79-23972# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
THREE-DIMENSIONAL INTERNAL FLOWS IN TURBOMACHINERY. TASK 1: SECONDARY FLOW IN DIFFUSING CASCADES Annual Technical Report, 1 Jan. - 31 Dec. 1978
Awatef A. Hamed 28 Feb. 1979 15 p refs
(Contract F49620-78-C-0041)
(AD-A065696; AFOSR-79-0250TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The nonviscous three-dimensional rotational flow is analyzed in highly curved channels. The problem is formulated in terms

of the velocity and vorticity. The secondary velocities are computed for the continuity and vorticity equations, which are nonhomogeneous first order equations. Previous formulations of these equations resulted in two second order differential equations. A new approach is developed, which is applicable in a generalized two dimensional domain or axisymmetric field. It is based on the definition of a streamlike function which is used to transform these nonhomogeneous first order partial differential equations to a single second order equation with Dirichlet boundary conditions over the solid boundaries. The new approach is superior in terms of computational time and storage requirements.
Author (GRA)

N79-23973# Kaman Aerospace Corp., Bloomfield, Conn.
DRIVESHAFT ALIGNMENT INDICATOR Final Technical Report, Nov. 1975 - May 1978
Frank A. Bill and Robert B. Bossler, Jr. Jan. 1979 117 p
(Contract DAAJ02-77-C-0006; DA Proj. 1L2-62209-AH-76)
(AD-A065988; R-1547; USARTL-TR-79-3) Avail: NTIS HC A06/MF A01 CSCL 01/3

The purpose of this program was to reduce the difficulty of drive-shaft alignment and to improve dynamic alignment by allowing inflight measurement on Army UH-1/AH-1 helicopters. Under Contract DAAJ02-76-C-0010, a first-concept driveshaft alignment indicator was investigated. The program included ground and flight tests on an Army UH-1 helicopter. A second-generation concept was evolved which indicated improved accuracy and greatly reduced system cost. The second-generation concept was investigated under Contract DAAJ02-77-C-0006. The investigation included design and manufacture of a prototype alignment measuring tool, ground and flight tests, and a survey of the existing driveshaft alignments of Army helicopters. The survey included eight UH-1 at Bradley Field, Connecticut, ten UH-1 at Felker Field, Fort Eustis, Virginia, and ten UH-1 at Simmons Field, Fort Bragg, North Carolina. Subsequently, three AH-1 were measured at Felker Field, and finally a UH-1 with sling load was measured at Kaman. The significant measurements were static alignment, hover at a 5-foot skid height, and low-speed high-power climb (70 knots forward speed, 1000 ft/minute climb). GRA

N79-23974# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
TURBINE DESIGN SYSTEM Final Technical Report, 1 Nov. 1975 - 30 Nov. 1977
R. R. Wysong, T. C. Prince, D. T. Lenahan, R. D. Caney, and J. S. Keith Nov. 1978 117 p refs
(Contract F33615-75-C-2073; AF Proj. 3066)
(AD-A066092; R78AEGXXX) Avail: NTIS HC A06/MF A01 CSCL 21/5

A time-sharing computer system has been developed which provides for the interactive design and analytical performance evaluation of aircraft engine turbines. The system is modularized to permit the user to deal with one functional aspect of the design at a time; twelve modules are employed to encompass the turbine aerodynamic, heat transfer, and mechanical design. The analytical and numerical methods employed in each module, and their theoretical basis, are presented in this report.
Author (GRA)

N79-23975# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ENGINE ROTOR DYNAMICS, SYNCHRONOUS AND NONSYNCHRONOUS WHIRL CONTROL Final Technical Report
Ronald A. Marmol Feb. 1979 53 p refs
(Contract DAAJ02-76-C-0011; DA Proj. 1F2-62209-AH-76)
(AD-A066093; FR-10632; USARTL-TR-79-2) Avail: NTIS HC A04/MF A01 CSCL 21/5

A combined analytical and test program has been performed to develop a method of designing high-speed power turbine rotors to (1) minimize rotor-induced dynamic loads under normal operating conditions, (2) minimize rotor tip-to-shroud clearance to maintain high flow-path efficiency, and (3) minimize rotor deflections due to sudden abusive imbalance loads associated with blade loss. A design/prediction system was established for both synchronous and nonsynchronous rotor whirl and the best compromise design for a rotor subjected to these excitations. Two mathematical models were developed in the course of the program. First, a squeeze film damper model and subsequent computer program were developed to quantify the effects of end-seal leakage and inlet feedback on damper performance. Secondly, a spline coupling friction mathematical model and computer program were developed to predict the destabilizing forces which excite rotor nonsynchronous whirl. To verify the accuracy of the analytical models developed in the program and other existing rotor dynamic models, a comprehensive test program was run. This program included: (1) a high speed film damper test rig, (2) bearing flexible support testing, (3) a synchronous response rotor rig, and (4) a nonsynchronous response rotor rig. Using the results of the analytical models and experimental tests, a method of design optimization was developed to obtain the best trade-off between all the rotor design variables considered in this program. Author (GRA)

N79-23976# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF RESONANCE VIBRATIONS OF TURBINE BLADES WITH THE ELURA DEVICE
I. Ye. Zablotskiy and Yu. A. Korostelev 15 Jun. 1978 15 p refs Transl. into ENGLISH from Energomashinostroneniye (USSR), no. 2, Feb. 1970 p 36-39
(AD-A066122; FTD-ID(RS)T-0861-78) Avail: NTIS HC A02/MF A01 CSCL 14/2

A method with the ELURA devices is used to measure the vibration of the resonance. The frequency of which is not a multiple of the number of revolutions is measured. The principle of the measurement arrangement of the sensors and the layout is described. S.E.S.

N79-23903*# Massachusetts Inst. of Tech., Cambridge.
DESIGN OF PROPELLERS FOR MOTORSOARERS
E. Eugene Larrabee *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 285-303 refs (For primary document see N79-23889 15-01) Avail: NTIS HC A13/MF A01 CSCL 01C

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-23977*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMPLIFIED ROTOR SYSTEM MATHEMATICAL MODEL FOR PILOTED FLIGHT DYNAMICS SIMULATION
Robert T. N. Chen May 1979 28 p refs
(NASA-TM-78575; A-7538) Avail: NTIS HC A03/MF A01 CSCL 01C

The model was developed for real-time pilot-in-the-loop investigation of helicopter flying qualities. The mathematical model included the tip-path plane dynamics and several primary rotor design parameters, such as flapping hinge restraint, flapping hinge offset, blade Lock number, and pitch-flap coupling. The model was used in several exploratory studies of the flying qualities of helicopters with a variety of rotor systems. The basic assumptions used and the major steps involved in the development of the set of equations listed are described. The equations consisted of the tip-path plane dynamic equation, the equations for the main rotor forces and moments, and the equation for control phasing required to achieve decoupling in pitch and roll due to cyclic inputs. S.E.S.

N79-23978*# Calspan Corp., Buffalo, N. Y.
ACTIVE CONTROL FOR THE TOTAL-IN-FLIGHT SIMULATOR (ACTIFS) Final Report
E. G. Rynaski, D. Andrisani, II, and N. Weingarten Apr. 1979 303 p refs Sponsored by NASA
(Contract F33615-73-C-3051)
(NASA-CR-3118; AK-5280-F-11) HC A14/MF A01 CSCL 01C

An identification procedure was developed that is used to

systematically improve or update the mathematical model of the aeroelastic behavior of an airplane. A mathematical model that was originally obtained by analytical or theoretical methods is made amenable to piecemeal acceptance of parameters estimated from the data taken during flight tests. Linear optimal control theory was used to evolve a performance index specifying closed loop system dynamics. Control laws for the proper pole placement of seven modes of motion of the TIFS airplane, two rigid body and five elastic modes, were specified according to criteria developed. The phase variable canonical transformation was used to help specify a minimum complexity observer network that required no interconnections of the sensor outputs and no measurements of the control input. A conceptual design example of a simplified observer feedback control law for structural mode control of the TIFS airplane is presented. Gust alleviation techniques involving direct gust measurement and maneuver load control techniques were also developed, resulting in a command augmentation system that simultaneously commands multiple surface deflections to a pilot command input. A.R.H.

N79-23979*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PRECISION CONTROLLABILITY OF THE F-15 AIRPLANE
Thomas R. Sisk and Neil W. Matheny May 1979 46 p refs (NASA-TM-72861; H-1073) Avail: NTIS HC A03/MF A01 CSCL 01C

A flying qualities evaluation conducted on a preproduction F-15 airplane permitted an assessment to be made of its precision controllability in the high subsonic and low transonic flight regime over the allowable angle of attack range. Precision controllability, or gunsight tracking, studies were conducted in windup turn maneuvers with the gunsight in the caged pipper mode and depressed 70 mils. This evaluation showed the F-15 airplane to experience severe buffet and mild-to-moderate wing rock at the higher angles of attack. It showed the F-15 airplane radial tracking precision to vary from approximately 6 to 20 mils over the load factor range tested. Tracking in the presence of wing rock essentially doubled the radial tracking error generated at the lower angles of attack. The stability augmentation system affected the tracking precision of the F-15 airplane more than it did that of previous aircraft studied. Author

N79-23980# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EVALUATION OF A DIGITAL HELICOPTER CONTROL SYSTEM
Wolfgang J. Kubbat 1977 13 p refs Presented at Assoc. Aeron. et Astronautique 3d European Rotocraft and Powered Lift Aircraft Forum, Aix-en-Provence, France, 7-9 Sep. 1977 (MBB-UFE-1349-O) Avail: NTIS HC A02/MF A01

An experimental digital control system for helicopter applications is described. The system incorporates the functions of control and stabilization, autopilot, air data computation and strap down computation. Realization of the system was made using a double processor computer. The control system and the sensors are selfmonitored, providing a fail safe capability for one channel. It may also be used in redundant applicatons. Successful flight tests were conducted. Author (ESA)

N79-23981# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON DYNAMIC STABILITY PARAMETERS
Lars E. Ericsson (LMSC, Sunnyvale, Calif.) Apr. 1979 16 p Symp. held at Athens, 22-24 May 1963
(AGARD-AR-137; ISBN-92-835-1320-7) Avail: NTIS HC A02/MF A01

An evaluation of the symposium is given along with the presentations made in the areas of: wind tunnel techniques; flight testing techniques; analytical techniques; motion analyses and nonlinear formulations; and sensitivity and simulator studies. In addition, a workshop session and roundtable discussion on the presentations are discussed. Conclusions on the state of the art and recommendations for future activity complete the evaluation. J.M.S.

N79-23895*# Bertelsen Mfg. Co., Inc., Neponset, Ill.
INTRODUCTION TO THE ARCOPTER ARC WING AND THE BERTELSEN EFFECT FOR POSITIVE PITCH STABILITY AND CONTROL
William D. Bertelsen *In* NASA. Langley Res. Center The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 103-130 refs (For primary document see N79-23889 15-01) Avail: NTIS HC A13/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-23982# Aeronautical Research Labs., Melbourne (Australia).
AN INTRODUCTION TO DYNAMIC DERIVATIVES. 2: THE EQUATIONS OF MOTION FOR WIND TUNNEL PITCH-YAW OSCILLATION RIGS
G. F. Forsyth Aug. 1978 22 p refs
(ARL-Aero-Note-377; AR-001-296) Avail: NTIS HC A02/MF A01

The equations of motion were developed for a simplified free flight pitch-yaw system and for spring-mounted and rigidly-driven wind tunnel systems. For the spring-mounted system both initial displacement and forced-oscillation conditions were examined. A simplified cable towed system was also derived. J.A.M.

N79-23983# National Mechanical Engineering Research Inst., Pretoria (South Africa). Heat Mechanics Div.
THE DESIGN, CONSTRUCTION AND CALIBRATION OF A RESEARCH COLD ROOM COMPLEX
G. Kerens and C. J. Visser Jul. 1978 25 p refs
(CSIR-ME-1577) Avail: NTIS HC A02/MF A01

A research cold room complex designed to carry out basic investigations into the various parameters involved in the chilling, storage, and freezing of meat is described. The refrigeration plant and the instrumentation used are included. Performance tests show that the complex is operating satisfactorily and that conditions can be controlled and monitored accurately. S.E.S.

N79-23984# ARO, Inc., Arnold Air Force Station, Tenn.
MODEL DIFFUSER INVESTIGATION FOR PROPULSION WIND TUNNEL 16T Final Report, 21 Apr. - 5 Sep. 1978
L. J. David and M. G. Hale AEDC 9 Nov. 1978 34 p refs
(AD-A065822; AEDC-TSR-78-P48) Avail: NTIS HC A03/MF A01 CSCL 20/4

A 1/16-scale model of the diffuser of the Propulsion Wind Tunnel (16T) was installed and tested in the Aerodynamic Wind Tunnel (1T). Objectives of the test were to evaluate the effectiveness of a number of geometric modifications of the diffuser to improve diffuser performance. Thirteen configurations involving combinations of six geometric modifications were evaluated in the tunnel Mach number range from 0.60 to 1.50. Author (GRA)

N79-23985# Air Force Human Resources Lab., Brooks AFB, Tex.
CONTRIBUTIONS OF PLATFORM MOTION TO SIMULATOR TRAINING EFFECTIVENESS. STUDY 2: AEROBATICS Interim Report, Mar. 1976 - Nov. 1977
Elizabeth L. Martin and Wayne L. Waag Sep. 1978 32 p refs
(AF Proj. 1123)
(AD-A064305; AFHRL-TR-78-52) Avail: NTIS HC A03/MF A01 CSCL 05/9

A transfer of training design was used to evaluate platform of simulator training with synergistic six-degree-of-freedom platform motion to the acquisition of aerobatic skills in the novice pilot. Thirty-six pilot trainees with no previous jet piloting experience were randomly assigned to one of the three groups:

motion, no-motion, and control. Student performances was evaluated by instructor ratings, and data cards. It is concluded, that from an operational viewpoint, the data revealed no practical value of platform motion cueing and questions the cost effectiveness of acrobatic simulator training. F.O.S.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-23986* National Aeronautics and Space Administration, Washington, D. C.
APOLLO 11: A GOOD ENDING TO A BAD DECADE
1 Jun. 1979 29 p
(NASA-News-Release-79-73; P79-10062) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The Gemini program and the Apollo program which culminated in landing a man on the moon and safely returning him to earth are highlighted. The space program in the aftermath of Apollo 11 is briefly summarized, including: Skylab, Apollo Soyuz, Mars and Venus probes, improved world communications, remote sensing of world resources, and finally, space shuttle. J.M.S.

N79-23987*# Science Applications, Inc., Schaumburg, Ill.
MERCURY ORBITER TRANSPORT STUDY
Alan L. Friedlander and Harvey Feingold Jan. 1977 128 p refs
(Contract NASw-2893)
(NASA-CR-158658; SAI-1-120-580-T6) Avail: NTIS HC A07/MF A01 CSCL 22A

A data base and comparative performance analyses of alternative flight mode options for delivering a range of payload masses to Mercury orbit are provided. Launch opportunities over the period 1980-2000 are considered. Extensive data trades are developed for the ballistic flight mode option utilizing one or more swingbys of Venus. Advanced transport options studied include solar electric propulsion and solar sailing. Results show the significant performance tradeoffs among such key parameters as trip time, payload mass, propulsion system mass, orbit size, launch year sensitivity and relative cost-effectiveness. Handbook-type presentation formats, particularly in the case of ballistic mode data, provide planetary program planners with an easily used source of reference information essential in the preliminary steps of mission selection and planning. S.E.S.

N79-23988# Committee on Commerce, Science, and Transportation (U. S. Senate).
US CIVILIAN SPACE POLICY
Washington GPO 1979 427 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 25, 31 Jan; 1 Feb. 1979
(GPO-42-110) Avail: Subcomm. on Sci., Technol., and Space

Testimony delivered and statements received concerning the President's space policy directive, its impact on NASA, and business and industrial opportunities in the shuttle ear are presented. Major initiatives from the offices of space science, space transportation systems, and planetary exploration are reviewed. The texts of the following are included: National Space and Aeronautics Policy Act of 1979 (S.212); Earth Data and Information on Service Act of 1978 (S.3589); the Space Policy Act of 1979 (S.244) and the Space Policy Act of 1978 (S.3530). A.R.H.

N79-23989# Aerospace Corp., El Segundo, Calif. Advanced Programs Div.
FIVE YEAR PLAN FOR SPACE TEST PROGRAM Final Report, 1 Jan. - 28 Aug. 1978
H. E. Frank Wang, R. G. Knauss, R. E. Underwood, and L. H. Weeks 28 Aug. 1978 171 p refs
(Contract F04701-77-C-0078)
(AD-A065866; TR-0078(3506-01)-1) Avail: NTIS HC A08/MF A01 CSCL 22/2

Examined available systems, services, and test methods afforded by the Shuttle to conduct space experiments. Assumed pathfinder role for DoD towards the full utilization of the Shuttle by developing (1) Common Support Equipment for astronaut assisted Sortie flights, and (2) cost effective approaches for primary and secondary free-flying spacecraft. Author (GRA)

N79-23990# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 627
8 May 1979 22 p Transl. into ENGLISH from various East European journals
(JPRS-73404) Avail: NTIS HC A02/MF A01

Success in using the suggestology method to facilitate the mastery and recall of large amounts of information in a relatively shore period of time is reported from Bulgaria. Progress in a large scale integration and the successful combination of plant and animal cells is Hungary are discussed as well as the contributions of Polish scientists and technicians to the Intercosmos program. For individual title, see N79-23991.

N79-23991# Joint Publications Research Service, Arlington, Va.
POLISH INTERKOSMOS PARTICIPATION DESCRIBED
Pawel Elsztein *In its* Transl. on Eastern Europe: Sci. Affairs, no. 627 (JPRS-73404) 8 May 1979 p 8-20 Transl. into ENGLISH from Skrzydlata Polska, (Warsaw), no. 7, 18 Feb. 1979 p 3-5 (For primary document see N79-23990 15-12)
Avail: NTIS HC A02/MF A01

The successful operation of the radiospectrograph carried by the Intercosmos-Copernicus 500 satellite for solar telemetry is described as well as the development of channel oscillators and antennas for the Intercosmos 18. The cooperation of Polish technicians and scientists with colleagues from East Germany, Hungary, Czechoslovakia, and the U.S.S.R. in the design of a uniform telemetry system is reported. Current projects include: work on the IRS-1 satellite radiospectrometer for the jonosond intercosmos 19 satellite; a VHF (up to 300 MHz) radio spectrum analyzer and Doppler-based device for observing earth-orbiting artificial satellites; and a highly stabilized quartz time standard for a system receiving and transmitting remote sensing data from satellites. A.R.H.

N79-24939# Joint Publications Research Service, Arlington, Va.
EXPERIMENTS OF USSR-CSSR COSMIC FLIGHT DESCRIBED
Michal Strida *In its* Transl. on Eastern Europe: Sci. Affairs, No. 625 (JPRS-73266) 20 Apr. 1979 p 1-5 Transl. into ENGLISH from Rude Pravo (Prague), 7 Mar. 1979 p 4 (For primary document see N79-24938 15-99)
Avail: NTIS HC A03/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-23992*# Analytical and Computational Mathematics, Zurich (Switzerland).
DEVELOPMENT OF ANALYTICAL ORBIT PROPAGATION TECHNIQUE WITH DRAG Final Report
Mar. 1979 12 p refs
(Contract NAS9-15445)
(NASA-CR-160176) Avail: NTIS HC A02/MF A01 CSCL 22A

Two orbit computation methods were used: (1) numerical method- The solution to the satellite differential equations were solved in a step-by-step manner, using a mathematical algorithm taken from numerical analysis; and (2) analytical method - The solution was expressed by explicit functions of the independent variable. Analytical drag modules, tesseral terms initialization module, second order and long period terms module, and

verification testing of the ASOP program were also considered. J.A.M.

N79-23993# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
SABAB: A PROGRAM FOR CALCULATING SATELLITE EPHERMERIDES
K. H. Kuebbeler and H. G. Peters Aug. 1978 22 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-10-78) Avail: NTIS HC A02/MF A01

Information on the use of the FORTRAN program SABAB is presented. SABAB calculates, with one of four different sets of orbital elements, topocentric horizontal coordinates for a specified station and the geographical coordinates of the satellite subpoint. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-23994*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY RESULTS OF THE DETERMINATION OF THE ORIENTATION OF INTERKOSMOS-17 AUOS
M. L. Pivovarov May 1979 13 p refs Transl. into ENGLISH of "Predvaritelnye Rezultaty Opredeleniya Orientatsii AUOS Interkosmos-17", Rept. PR-437 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-8 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75613; Pr-437) Avail: NTIS HC A02/MF A01 CSCL 22A

An algorithm for determining the orientation of the Interkosmos-17 automatic multipurpose orbital station is discussed. The graphs provided show variations of the satellite's orientation, relative to a given orientation in an orbital system of coordinates. M.M.M.

N79-23995*# National Aeronautics and Space Administration, Washington, D. C.
EVOLUTION OF THE ROTATION OF AN ARTIFICIAL EARTH SATELLITE UNDER THE INFLUENCE OF A PERTURBING MOMENT WHICH IS CONSTANT IN FIXED AXES
A. I. Neyshtadt and M. L. Pivovarov May 1979 11 p refs Transl. into ENGLISH of "Ob Evolyutsii Vrashcheniya ISZ Pod Deystviem Vozmushchayushchego Momenta, Postoyannogo v Svyazannykh Osyakh", Rept. Pr-434 Acad. of Sci. USSR, Inst. of Space Res., Moscow, Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75614; Pr-434) Avail: NTIS HC A02/MF A01 CSCL 22A

The change in the modulus of the vector of the kinetic moment of a satellite which is noted during the determination of the actual orientation of an artificial earth is discussed. The change is due to the presence of a small perturbing moment, which is constant in fixed axes relative to the satellite. It is also shown that the averaged equations in this problem can be integrated. R.E.S.

N79-23996*# Computer Sciences Corp., Silver Spring, Md.
CONTINGENCY STUDY FOR THE THIRD INTERNATIONAL SUN-EARTH EXPLORER (ISEE-3) SATELLITE
D. W. Dunham May 1979 61 p refs
(Contract NAS5-24300)
(NASA-CR-159931; CSM/TM-79/6018) Avail: NTIS HC A04/MF A01 CSCL 22A

The third satellite of the international Sun-Earth Explorer program was inserted into a periodic halo orbit about L sub 1, the collinear libration point between the Sun and the Earth-Moon barycenter. A plan is presented that was developed to enable insertion into the halo orbit in case there was a large underperformance of the Delta second or third stage during the maneuver to insert the spacecraft into the transfer trajectory. After one orbit of the Earth, a maneuver would be performed near perigee to increase the energy of the orbit. A relatively small second maneuver would put the spacecraft in a transfer trajectory to the halo orbit, into which it could be inserted for a total cost within the fuel budget. Overburns (hot transfer trajectory insertions) were also studied. J.A.M.

N79-24751*# Navy Astronautics Group, Point Mugu, Calif.
TRANSIT SATELLITE SYSTEM TIMING CAPABILITIES
Theodore D. Finsod *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 511-535 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N79-23997*# Boeing Aerospace Co., Seattle, Wash.
A TURBOJET-BOOSTED TWO-STAGE-TO-ORBIT SPACE TRANSPORTATION SYSTEM DESIGN STUDY Final Report
A. K. Hepler, H. Zeck, W. Walker, and W. Scharf Apr. 1979 156 p
(Contract NAS1-15204)
(NASA-CR-159018) Avail: NTIS HC A08/MF A01 CSCL 22B

The concept to use twin turbo-powered boosters for acceleration to supersonic staging speed followed by an all rocket powered orbiter stage was proposed. A follow-on design study was then made of the concept with the performance objective of placing a 29,483 Kg payload into a .2.6 X 195.3 km orbit. The study was performed in terms of analysis and trade studies, conceptual design, utility and economic analysis, and technology assessment. Design features of the final configuration included: strakes and area rule for improved take off and low transonic drag, variable area inlets, exits and turbine, and low profile fixed landing gear for turbojet booster stage. The payload required an estimated GLOW of 1,270,000 kg for injection in orbit. Each twin booster required afterburning turbojet engines each with a static sea level thrust rating of 444,800 N. Life cycle costs for this concept were comparable to a SSTO/SLED concept except for increased development cost due to the turbojet engine propulsion system. R.E.S.

N79-23998# General Electric Co., Philadelphia, Pa. Space Div.
STANDARD TEST RACK. CONCEPT DEFINITION STUDY. STRUCTURAL ANALYSIS REPORT Final Report, 19 Jul. - 1 Nov. 1978
Jan. 1979 129 p refs
(Contract F04701-77-C-0116)
(AD-A066247; SAMSO-TR-78-148) Avail: NTIS HC A07/MF A01 CSCL 14/2

DoD Standard Test Rack Structural/Dynamic Analysis for critical loading conditions. NASTRAN converter model developed for coupled STS/STR Transient analysis high payload weight capability of STR investigated. Author (GRA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-23999*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMMUNICATIONS TECHNOLOGY SATELLITE: UNITED STATES EXPERIMENTS AND DISASTER COMMUNICATIONS APPLICATIONS

Patrick Donoughe, Henry R. Hunczak, and Guy S. Gurski 1978 45 p refs Presented at the United Regional Seminar on the Use of Satellite Technol. for Disaster Appl., Sao Paulo, Brazil, 2-13 Oct. 1978

(NASA-TM-79109; E-9935) Avail: NTIS HC A03/MF A01 CSCL 17B

Ground antennas from 0.6 to 5.0 meters in diameter were used as remote earth terminals by the United States for both wideband (television) and narrowband (voice, data) communication in conjunction with the Canadian Hermes satellite's high power transmitter. Experiments summarized cover teleconferencing and duplex videoconferencing for medical, educational, and civic purposes, as well as the remote interpretation of multilingual broadcasts from the United Nations. The capabilities of the system during real and simulated disasters at airports are assessed. Particular attention is given to miniexperiments for flood control in the Mississippi River basin and in Johnstown, Pennsylvania during the 1977 flood. A.R.H.

N79-24759*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PTTI APPLICATIONS TO DEEP SPACE NAVIGATION

David W. Curkendall *In* NASA. Goddard Space Flight Center Proc. of 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1979 p 659-691 refs (For primary document see N79-24731 15-70)

Avail: NTIS HC A99/MF A01 CSCL 22A

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-24000*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASCAP MODELLING OF HIGH-VOLTAGE POWER SYSTEM INTERACTIONS WITH SPACE CHARGED-PARTICLE ENVIRONMENTS

N. John Stevens, James C. Roche, and Myron J. Mandell (Systems, Science and Software, La Jolla, Calif.) 1979 20 p refs Presented at the High Voltage Workshop, Anaheim, Calif., 26-27 Feb. 1979; sponsored by IEEE

(NASA-TM-79146; E-001) Avail: NTIS HC A02/MF A01 CSCL 22B

A simple space power system operating in geosynchronous orbit was analyzed. This system consisted of two solar array wings and a central body. Each solar array wing was considered to be divided into three regions operating at 2000 volts. The center body was considered to be an electrical ground with the array voltages both positive and negative relative to ground. The system was analyzed for both a normal environment and a moderate geomagnetic substorm environment. Initial results indicate a high probability of arcing at the interconnects on the negative operating voltage wing. The dielectric strength of the substrate may be exceeded giving rise to breakdown in the bulk of the material. The geomagnetic substorm did not seem to increase the electrical gradients at the interconnects on the negative operating voltage wing but did increase the gradients on the positive operating voltage wing which could result in increased coupling current losses. R.E.S.

N79-24001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPACECRAFT CHARGING TECHNOLOGY, 1978

1979 908 p refs Conf. held at Colorado Springs, Colo., 31 Oct. - 2 Nov. 1978; sponsored by NASA and AFGL

(NASA-CP-2071; AFGL-TR-79-0082) Avail: NTIS HC A99/MF A01 CSCL 22B

The interaction of the aerospace environment with spacecraft surfaces and onboard, high voltage spacecraft systems operating over a wide range of altitudes from low Earth orbit to geosynchronous orbit is considered. Emphasis is placed on control of spacecraft electric potential. Electron and ion beams, plasma neutralizers material selection, and magnetic shielding are among the topics discussed. For individual titles, see N79-24002 through N79-24057.

N79-24002*# Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.

DESCRIPTION OF THE SPACE TEST PROGRAM P78-2 SPACECRAFT AND PAYLOADS

John C. Durrett and John R. Stevens *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 4-10 Prepared in cooperation with Aerospace Corp., El Segundo, Calif. (For primary document see N79-24001 15-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The P78-2 spacecraft and its payloads are designed to measure the environment at near synchronous altitude and the interactions of the environment on the spacecraft. A brief description of each payload is provided. J.M.S.

N79-24003*# Air Force Geophysics Lab., Hanscom AFB, Mass.

MODELING OF THE GEOSYNCHRONOUS PLASMA ENVIRONMENT

H. B. Garrett *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 11-22 refs (For primary document see N79-24001 15-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

An analytic simulation of the geosynchronous environment in terms of local time and the daily A sub P index is presented. The simulation is compared with actual statistical data from approximately 50 days of ATS 5 plasma data and 50 days of ATS 6 plasma data. At low levels of activity the model adequately simulates the local time variations of the plasma parameters. At high values of geomagnetic activity, the predicted magnitudes of the plasma parameters agree with the statistical results but the effects of multiple injections are evident in both the data and the simulation, biasing the local time variations. Author

N79-24004*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AVERAGE PLASMA ENVIRONMENT AT GEOSYNCHRONOUS ORBIT

S.-Y. Su (Lockheed Electron. Co., Plainfield, N. J.) and A. Konradi *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 23-37 refs (For primary document see N79-24001 15-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The average plasma environment at geosynchronous orbit (GSO) is derived from a whole year's worth of plasma data obtained by the UCSD electrostatic electrometer on board ATS 5. The result is primarily intended for use as a general reference for engineers designing a large spacecraft to be flown at GSO. A simple mathematical formula using a 3rd order polynomial is found to be adequate for representing the yearly averaged particle energy spectrum from 70 to 41,000 eV under

different geomagnetic conditions. Furthermore, correlation analyses with the geomagnetic planetary index Kp and with the auroral electrojet index AE were carried out in the hope that the ground observations of the geomagnetic field variations can be used to predict the plasma variations in space. Unfortunately, the results indicate that such forecasting is not feasible by use of these two popular geomagnetic parameters alone. Author

N79-24005*# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATS-5 AND ATS-6 POTENTIALS DURING ECLIPSE
Allen G. Rubin and Henry B. Garrett *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 38-43 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The ATS 5 and ATS 6 data for spacecraft charging during eclipse conditions is analyzed. The ATS 5 and ATS 6 charged to voltages greater than 100 volts for about 55 percent of the eclipse periods examined. The mean spacecraft potential during eclipse was 2 keV for ATS 5, and the highest potential measured was 10 kilovolts. For ATS 6, the mean potential during eclipse was 4 keV, the highest potential measured 20 keV. The average measured spacecraft potentials for both ATS 5 and 6 depend approximately linearly upon Kp. This relationship is due mainly to the dependence of electron current density on Kp near midnight. Spacecraft potentials at geosynchronous orbit may, to a rough approximation, thus be inferred from ground-based measurements of Kp, the planetary 3-hour index. Author

N79-24006*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF THE TWO YEAR NASA PROGRAM FOR ACTIVE CONTROL OF ATS-5/6 ENVIRONMENTAL CHARGING
Robert O. Bartlett and Carolyn K. Purvis *In its* Spacecraft Charging Technol., 1978 1979 p 44-58 refs Prepared in cooperation with NASA. Goddard Space Flight Center (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Experiments conducted on the ATS 5 and ATS 6 which have demonstrated the feasibility of modifying or clamping the environmentally induced potential of these spacecraft are described. The results of these experiments indicate that a thermionic electron source is capable of replacing photo-emitted electrons during eclipse. However, the utility of this type of device is limited if its emission is suppressed by local electric fields. On the other hand, it is shown that a plasma source will not only serve as a substitute for photo-emitted electrons but will also suppress differential charging of isolated elements of the spacecraft which would tend to suppress electron emission. This later device is therefore capable of clamping the potential of a spacecraft without special considerations of its coupling to the ambient plasma. J.M.S.

N79-24007*# California Univ., San Diego.
OPERATIONS OF THE ATS-6 ION ENGINE
R. C. Olsen and E. C. Whipple *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 59-68 refs (For primary document see N79-24001 15-18)
(Grant NsG-3150)
Avail: NTIS HC A99/MF A01 CSCL 22B

The ion engine experiments on ATS 6 were operated in daylight and eclipse. The effect on particle fluxes to the spacecraft was monitored with the UCSD Auroral Particles Experiment. These data also provide information on the potential of the spacecraft with respect to the ambient plasma and on the local electric fields caused by the charge distribution on the satellite. Daylight operations of the plasma bridge neutralizer and the cesium thruster in fall, 1974, served to hold the spacecraft between -3 and -8 volts with respect to the ambient plasma. Neutralizer operation reduced differential charging effects, while operation of the thruster usually reduced the effects below the detectors sensitivity. Eclipse operations of the neutralizer reduced kilovolt negative potentials to a few volts. Operation of the thruster prevented possible charging of the satellite during substorms, making it possible to study low energy particle spectra which are at times obscured by charging during substorms. J.M.S.

N79-24008*# California Univ., San Diego.
CHARACTERISTICS OF DIFFERENTIAL CHARGING OF ATS-6
Bruce Johnson and Elden C. Whipple *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 69-79 refs (For primary document see N79-24001 15-18)
(Grant NsG-3150)
Avail: NTIS HC A99/MF A01 CSCL 22B

Thirteen days of data collected by the Auroral Particle Experiment onboard the ATS 6 were analyzed emphasizing peculiarities in the electron data attributed to differential charging. On one of these days the satellite was eclipsed by the earth at local midnight. Spectrograms were used to examine the data. It is concluded that differential charging is responsible for returning photoelectrons to the spacecraft up to a couple hundred eV, depending on the spacecraft charge. It is believed that the Minnesota experiment on ATS 6 is largely responsible for producing a potential barrier that returns particles and produces intense spon spots in the count rates. J.M.S.

N79-24009*# Air Force Geophysics Lab., Hanscom AFB, Mass.
DESIGN, DEVELOPMENT, AND FLIGHT OF A SPACECRAFT CHARGING SOUNDING ROCKET PAYLOAD
H. A. Cohen, C. Sherman, E. G. Mullen, W. B. Huber (Tri-Con Assoc., Inc.), T. D. Masek (Hughes Res. Labs.), R. B. Sluder (PhotoMetrics, Inc.), P. F. Mizera (Aerospace Corp., El Segundo, Calif.), E. R. Schnauss (Aerospace Corp., El Segundo, Calif.), R. C. Adamo (SRI Intern. Corp., Menlo Park, Calif.), and J. E. Nanevicz (SRI Intern. Corp., Menlo Park, Calif.) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 80-90 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Results of the flight of the spacecraft charging sounding rocket payload are given. The payload was designed to create charging by the emission of both positive ions and electrons. The relationship between environmental parameters and changes in vehicle potential during periods of emission was also studied. J.M.S.

N79-24010*# Aerospace Corp., El Segundo, Calif.
DESCRIPTION AND CHARGING RESULTS FROM THE RSPM
P. F. Mizera, E. R. Schnauss, R. Vandre, and E. G. Mullen (AFGL) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 91-100 (For primary document see N79-24001 15-18)
(Contract F04701-78-C-0079)
Avail: NTIS HC A99/MF A01 CSCL 22B

Representative satellite materials, to be flown on STP-78-2 in 1979 on the SSPM instruments, were included as part of the AFGL Rocket payload flown from White Sands Missile Range on January 21, 1978. Potentials as high as + 1100 volts on the conductor and + or - 400 volts on the insulator were recorded by the RSPM near the minimum in the electron density vs altitude profile. In addition to the charging potentials measured during ion gun operation, sample charging currents also were recorded with time resolutions near 30 milliseconds. These results demonstrate the validity of the experiment concept of the SSPM on SCATHA. Author

N79-24011*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CAPABILITIES OF THE NASA CHARGING ANALYZER PROGRAM
I. Katz, J. J. Cassidy, M. J. Mandell, G. W. Schnuelle, P. G. Steen, and J. C. Roche *In its* Spacecraft Charging Technol., 1978 1979 p 101-122 refs Prepared in cooperation with Systems, Science and Software, La Jolla, Calif. (For primary document see N79-24001 15-18)
(Contract NAS3-21050)
Avail: NTIS HC A99/MF A01 CSCL 22B

Desirable features in a spacecraft modeling code are enumerated. The NASCAP is discussed in terms of its approach to the problem. Samples of problem setup and output are provided which demonstrate the ease with which the program can be used. A simple but interesting case of spacecraft charging is examined, and other applications are discussed. Author

N79-24012*# Systems Science and Software, La Jolla, Calif.
CHARGING ANALYSIS OF THE SCATHA SATELLITE
G. W. Schnuelle, D. E. Parks, I. Kaz, M. J. Mandell, P. G. Steen, J. J. Cassidy, and A. G. Rubin (AFGL) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 123-143 refs (For primary document see N79-24001 15-18)
(Contract NAS3-21050)
Avail: NTIS HC A99/MF A01 CSCL 22B

A detailed model of the geometrical, material, and electrical properties of the SCATHA satellite for use with the NASA charging analyzer program is described. Charging calculations in an intense magnetospheric substorm environment demonstrated that: (1) long booms can significantly perturb the potentials near the spacecraft, and (2) discharging by sunlight or by active control can cause serious time-dependent differential charging problems. J.A.M.

N79-24013*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF NASCAP PREDICTIONS WITH EXPERIMENTAL DATA
James C. Roche and Carolyn K. Purvis *In its* Spacecraft Charging Technol., 1978 1979 p 144-157 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The NASA charging analyzer program (NASCAP) is a three dimensional, finite element computer code capable of simulating the electrostatic charging of an arbitrary body either in a ground test tank or in the space environment. The code incorporated surface property parameters needed to simulate insulating and conducting materials. These parameters are being updated as required to bring the NASCAP predictions into correspondence with data from ground tests. NASCAP predictions are also being compared with data from the ATS 5 spacecraft. The significance of these results is discussed. J.A.M.

N79-24014*# General Electric Co., Philadelphia, Pa. Space Div.
SPACECRAFT CHARGING RESULTS FOR THE DSCS-3 SATELLITE
Michael J. Massaro and Dale Ling *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 158-178 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Spacecraft charging results are presented for the DSCS-3 satellite for a severe geomagnetic substorm. Spacecraft charging results were obtained by the use of the electrostatic charging analysis program (ESCAP). The ESCAP computer code which can determine both the transient or steady state differential charging potentials was an engineering design tool that utilized a circuit theory approach to spacecraft charging. Using the ESCAP code, the steady state (static) differential potentials of the outer spacecraft surfaces and metallic structure were obtained for the DSCS-3 satellite when under the influence of a severe geomagnetic substorm during the local midnight-to-dawn quadrant of its geosynchronous orbital path. The results indicated that, in the steady state, most of the DSCS-3 outer surface materials will not achieve differential potentials large enough to produce an electrostatic discharge. J.A.M.

N79-24015*# York Univ., Downsview (Ontario). Center for Research in Experimental Space Science.
PREDICTION OF ION DRIFT EFFECTS ON SPACECRAFT FLOATING POTENTIALS
Jen-Shih Chang, S. M. L. Prokopenko, R. Godard, and J. G. Laframboise *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 179-187 refs (For primary document see N79-24001 15-18)
(Grant AF-AFOSR-2962-76)
Avail: NTIS HC A99/MF A01 CSCL 22B

The plasma environment of high altitude spacecraft was observed to involve ion drift velocities which sometimes become comparable to ion mean thermal speeds. Such drifts may cause an electrically isolated spacecraft surface to float at a substantially increased negative potential if it is simultaneously shaded and downstream relative to the drift direction. The results showed that: (1) the ion speed ratio at which drift effects become important (i.e. change the floating potential by at least 10 percent) can be as low as 0.1, and may be decreased if the ambient electrons are non-Maxwellian; (2) the effects of ion speed ratio increase with increasing ion-to-electron temperature ratio; and (3) negative floating potentials for drifting Maxwellian ion velocity distributions with speed ratio unity are typically about twice as large as the corresponding potentials for nondrifting conditions. J.A.M.

N79-24016*# York Univ., Downsview (Ontario). Dept. of Physics.
NUMERICAL CALCULATIONS OF HIGH-ALTITUDE DIFFERENTIAL CHARGING: PRELIMINARY RESULTS
J. G. Laframboise, R. Godard, and S. M. L. Prokopenko *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 188-196 refs (For primary document see N79-24001 15-18)
(Grant AF-AFOSR-2962-76)
Avail: NTIS HC A99/MF A01 CSCL 22B

A two dimensional simulation program was constructed in order to obtain theoretical predictions of floating potential distributions on geostationary spacecraft. The geometry was infinite-cylindrical with angle dependence. Effects of finite spacecraft length on sheath potential profiles can be included in an approximate way. The program can treat either steady-state conditions or slowly time-varying situations, involving external time scales much larger than particle transit times. Approximate, locally dependent expressions were used to provide space charge, density profiles, but numerical orbit-following is used to calculate surface currents. Ambient velocity distributions were assumed to be isotropic, beam-like, or some superposition of these. J.A.M.

N79-24017*# Northeastern Univ., Boston, Mass.
ANALYTICAL STUDY OF THE TIME DEPENDENT SPACECRAFT-PLASMA INTERACTION
J. W. Cipolla, Jr. and M. B. Silevitch *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 197-208 refs (For primary document see N79-24001 15-18)
(Contract F19628-76-C-0246; Grant AF-AFOSR-3731-78)
Avail: NTIS HC A99/MF A01 CSCL 22B

A study of the time dependent interaction of an initially uniform equilibrium plasma with a plane conducting surface was made in order to achieve a more complete understanding of the dynamics of the charging process and of the approach to the floating potential on the surface. Numerical solutions of the cold ion equations of motion in conjunction with equilibrium electrons and Poisson's equation show the formation of an ion-rich sheath near the surface and the coupling of the non-neutral region to the undisturbed plasma through a quasineutral rarefaction. Analytical treatment of the quasineutral region showed excellent agreement (within 1 percent) with the numerical results. Author

N79-24018*# Science Applications, Inc., La Jolla, Calif.
ELECTRON TRANSPORT MODEL OF DIELECTRIC CHARGING
Brian L. Beers, Hsing-chow Hwang, Dong L. Lin, and Vernon W. Pine *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 209-238 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A computer code (SCCPOEM) was assembled to describe the charging of dielectrics due to irradiation by electrons. The primary purpose for developing the code was to make available a convenient tool for studying the internal fields and charge densities in electron-irradiated dielectrics. The code, which is based on the primary electron transport code POEM, is applicable to arbitrary dielectrics, source spectra, and current time histories. The code calculations are illustrated by a series of semianalytical solutions. Calculations to date suggest that the front face electric field is insufficient to cause breakdown, but that bulk breakdown fields can easily be exceeded. Author

N79-24019*# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE CALCULATION OF SPACECRAFT POTENTIAL: COMPARISON BETWEEN THEORY AND OBSERVATION
H. B. Garrett *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 239-255 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A simple charge balance model based on the work of DeForest was adapted for the calculation of spacecraft potentials. The model was calibrated with ATS 5 plasma data. Once calibrated, the model was used to calculate the time-varying potential that was observed as a spacecraft passes in and out of eclipse. Errors on the order of + or - 800 volts were observed over a range of 0 to -10,000 volts. Possible applications of the model to large space structures are discussed. J.A.M.

N79-24020*# California Univ., Berkeley.
SPACECRAFT POTENTIAL CONTROL ON ISEE-1
A. Gonfalone (European Space Agency, Paris), A. Pedersen (European Space Agency, Paris), U. V. Fahleson (Royal Inst. of Tech.), C.-G. Faelthammar (Royal Inst. of Tech.), F. S. Mozer, and R. B. Torbert *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 256-267 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Active control of the potential of the ISEE-1 satellite by the use of electron guns is reviewed. The electron guns contain a special cathode capable of emitting an electron current selectable between 10 to the -8th power and 10 to the -3rd power at energies from approximately .6 to 41 eV. Results obtained during flight show that the satellite potential can be stabilized at a value more positive than the normally positive floating potential. The electron guns also reduce the spin modulation of the spacecraft potential which is due to the aspect dependent photoemission of the long booms. Plasma parameters like electron temperature and density can be deduced from the variation of the spacecraft potential as a function of the gun current. The effects of electron beam emission on other experiments are briefly mentioned. J.A.M.

N79-24021*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTIONS BETWEEN SPACECRAFT AND THE CHARGED-PARTICLE ENVIRONMENT
N. John Stevens *In its* Spacecraft Charging Technol., 1978 1979 p 268-294 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Spacecraft-environment interactions are defined as the responses of a spacecraft surface to a charged-particle environment. This response can influence spacecraft system performance. Interactions can be divided into two broad categories: spacecraft passive, in which the environment acts on the spacecraft; and spacecraft active, in which the spacecraft causes the interaction. Passive interactions include the spacecraft-charging phenomenon. Active interactions include the relatively new interactions arising from the use of very large spacecraft and space power systems in future missions. To illustrate active interactions, a large power system operating at elevated voltages is considered. Possible interactions are described, available experimental data are reviewed, and the effect on power system performance is estimated. G.Y.

N79-24022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASMA INTERACTION EXPERIMENT (PIX) FLIGHT RESULTS
Norman T. Grier and N. John Stevens *In its* Spacecraft Charging Technol., 1978 1979 p 295-314 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

An auxiliary payload package called PIX (plasma interaction experiment) was launched on March 5, 1978, on the LANDSAT 3 launch vehicle to study interactions between the space charged-particle environment and surfaces at high applied positive and negative voltages. Three experimental surfaces were used in this package: a plain disk to act as a control, a disk on a Kapton sheet to determine the effect of surrounding insulation on current collection, and a small solar-array segment to evaluate the effect of distributing biased surfaces among an array of insulators. Only half of the results from the 4 hours of PIX operations were recovered. The results did verify effects found in ground simulation testing. The results of this experiment are discussed in detail. G.Y.

N79-24023*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHEATH EFFECTS OBSERVED ON A 10 METER HIGH VOLTAGE PANEL IN SIMULATED LOW EARTH ORBIT PLASMA
James E. McCox and Andrei Konradi *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 315-340 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A large (1m x 10m) flat surface of conductive material was biased to high voltage (+ or - 3000 V) to simulate the behavior of a large solar array in low earth orbit. The model array was operated in a plasma environment of 1,000 to 1,000,000/cu cm, with sufficient free space around it for the resulting plasma sheaths to develop unimpeded for 5-10 meters into the surrounding plasma. Measurements of the resulting sheath thickness were obtained. The observed thickness varied approximately as V to the 3/4 power and N to the 1/2 power. This effect appears to limit total current leakage from the test array until sheath dimensions exceed about 1 meter. Total leakage current was also measured with the array. G.Y.

N79-24024*# Parker (Lee W.), Inc., Concord, Mass.
PLASMA SHEATH EFFECTS AND VOLTAGE DISTRIBUTIONS OF LARGE HIGH-POWER SATELLITE SOLAR ARRAYS
Lee W. Parker *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 341-357 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Knowledge of the floating voltage configuration of a large array in orbit is needed in order to estimate various plasma-interaction effects. The equilibrium configuration of array voltages relative to space depends on the sheath structure. The latter dependence for an exposed array is examined in the light of two finite-sheath effects. One effect is that electron currents may be seriously underestimated. The other is that a potential barrier for electrons can occur, restricting electron currents. A conducting surface is assumed on the basis of a conductivity argument. Finite-sheath effects are investigated. The results of assuming thin-sheath and thick-sheath limits on the floating configuration of a linearly connected array are studied. Sheath thickness and parasitic power leakage are estimated. Numerically computed fields using a 3-D code are displayed in the thick-sheath limit. G.Y.

N79-24025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF PARASITIC PLASMA CURRENTS ON SOLAR-ARRAY POWER OUTPUT
Stanley Domitz and Joseph C. Kolecki *In its* Spacecraft Charging Technol., 1978 1979 p 358-375 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Solar-array voltage-current curves are calculated by assuming the existence of parasitic loads that consist of local currents of charged particles collected by the array. Three cases of interest are calculated to demonstrate how the distribution and magnitude of parasitic currents affect output. Solar array performance degradation became significant when the total parasitic current plus the load current exceeded the short-circuit current. Approximate graphical methods were useful for many applications. Power loss, which was calculated by summing the product of parasitic current and the local potential, underestimated the loss in maximum power. G.Y.

N79-24026*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAGNETIC SHIELDING OF LARGE HIGH-POWER-SATELLITE SOLAR ARRAYS USING INTERNAL CURRENTS
Lee W. Parker (Parker (Lee W.), Inc., Concord, Mass.) and William A. Oran *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 376-387 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Present concepts for solar power satellites involve dimensions up to tens of kilometers and operating internal currents up to

hundreds of kiloamperes. A question addressed is whether the local magnetic fields generated by these strong currents during normal operation can shield the array against impacts by plasma ions and electrons (and from thruster plasmas) which can cause possible losses such as power leakage and surface erosion. One of several prototype concepts was modeled by a long narrow rectangular panel 2 km wide and 20 km long. The currents flow in a parallel across the narrow dimension (sheet current) and along the edge (wire currents). The wire currents accumulate from zero to 100 kiloamp and are the dominant sources. The magnetic field is approximated analytically. The equations of motion for charged particles in this magnetic field are analyzed. The ion and electron fluxes at points on the surface are represented analytically for monoenergetic distributions and are evaluated. G.Y.

N79-24027*# Grumman Aerospace Corp., Bethpage, N.Y.
ENVIRONMENTAL INTERACTION IMPLICATIONS FOR LARGE SPACE SYSTEMS
E. Miller, W. Fischbein, M. C. Stauber, and P. K. Suh *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 388-407 (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Large Space Systems (LSS) comprise a new class of spacecraft, the design and performance of which may be seriously affected by a variety of environmental interactions. The special concerns associated with spacecraft charging and plasma interactions from the LSS designer's viewpoint are addressed. Survivability of these systems under combined solar U.V., particle radiation and repeated electrical discharges is of primary importance. Additional questions regard the character of electrical discharges over very large areas, the effects of high current/voltage systems and magnitude of induced structural disturbances. A concept is described for a large scale experiment platform. G.Y.

N79-24028*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
SPACE ENVIRONMENTAL EFFECTS AND THE SOLAR POWER SATELLITE
John W. Freeman, David Cooke, and Patricia Reiff *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 408-418 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Some preliminary findings regarding the interactions between the space plasma at GEO and the Marshall Space Flight Center January 1978 baseline Satellite Power Systems (SPS) design are summarized. These include the following: (1) the parasitic load will be dominated by photoelectrons and will amount to about 34 MW; (2) material of higher conductivity than kapton should be used for the solar reflector substrate and the solar cell blanket support material; (3) the satellite structure and solar reflector should be tied electrically to midpoint voltage of each solar cell array; and (4) tests should be run on the proposed solar cell cover glass material (synthetic sapphire) to determine if breakdown is expected. G.Y.

N79-24029*# Boeing Aerospace Co., Seattle, Wash.
PLASMA PARTICLE TRAJECTORIES AROUND SPACECRAFT PROPELLED BY ION THRUSTERS
H. B. Liemohn, R. L. Copeland, and W. M. Leavens *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 419-436 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The thruster plasma is assumed to be described by a collimated energetic beam and a cloud of ionized thermal propellant produced by charge-exchange. A simple adiabatic model is used to describe the expansion of these neutral plasmas away from the source. As the pressure falls, shielding currents dissipate, and the geomagnetic field takes control of the particles. In low earth orbit, it is concluded that the vehicle easily outruns its thruster plasma. At geosynchronous altitude, the local electric fields around high voltage surfaces collect return current from the thermal plasma that appears to be limited only by the available space charge. Results appropriate to proposed electric propulsion missions and the solar power satellite are presented and operational considerations are discussed. Author

N79-24030*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF MATERIALS CHARACTERIZATION STUDIES
Carolyn K. Purvis *In its* Spacecraft Charging Technol., 1978 1979 p 437-456 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

In the context of the spacecraft charging technology investigation, studies were made to characterize the response of typical spacecraft surface materials to the charging environment. The objective is to obtain an understanding of the charging and discharging behavior of such materials for the reliable prediction of spacecraft response to charging environments and as a guide for the design of future spacecraft. Materials were characterized in terms of such basic properties as resistivity and secondary emission and in terms of charging and discharging behavior in simulated charging environments. G.Y.

N79-24031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEST RESULTS FOR ELECTRON BEAM CHARGING OF FLEXIBLE INSULATORS AND COMPOSITES
John V. Staskus and Frank D. Berkopec *In its* Spacecraft Charging Technol., 1978 1979 p 457-484 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Flexible solar-array substrates, graphite-fiber/epoxy - aluminum honeycomb panels, and thin dielectric films were exposed to monoenergetic electron beams ranging in energy from 2 to 20 keV in the Lewis Research Center's geomagnetic-substorm-environment simulation facility to determine surface potentials, dc currents, and surface discharges. The four solar-array substrate samples consisted of Kapton sheet reinforced with fabrics of woven glass or carbon fibers. They represented different construction techniques that might be used to reduce the charge accumulation on the array back surface. Five honeycomb-panel samples were tested, two of which were representative of Voyager antenna materials and had either conductive or nonconductive painted surfaces. A third sample was of Navstar solar-array substrate material. The other two samples were of materials proposed for use on Intelsat V. All the honeycomb-panel samples had graphite-fiber/epoxy composite face sheets. The thin dielectric films were 2.54-micrometer-thick Mylar and 7.62-micrometer-thick Kapton. A.R.H.

N79-24032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AREA SCALING INVESTIGATIONS OF CHARGING PHENOMENA
Paul R. Aron and John V. Staskus *In its* Spacecraft Charging Technol., 1978 1979 p 485-506 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The charging and discharging behavior of square, planar samples of silvered, fluorinated ethylene-propylene (FEP) Teflon thermal control tape was measured. The equilibrium voltage profiles scaled with the width of the sample. A wide range of discharge pulse characteristics was observed, and the area dependences of the peak current, charge, and pulse widths are described. The observed scaling of the peak currents with area was weaker than that previously reported. The discharge parameters were observed to depend strongly on the grounding impedance and the beam voltage. Preliminary results suggest that measuring only the return-current-pulse characteristics is not adequate to describe the spacecraft discharging behavior of this material. The seams between strips of tape appear to play a fundamental role in determining the discharging behavior. An approximate propagation velocity for the charge cleanoff was extracted from the data. The samples - 232, 1265, and 5058 square centimeters in area - were exposed at ambient temperature to a 1- to 2-nA/sq cm electron beam at energies of 10, 15, and 20 kilovolts in a 19-meter-long by 4.6-meter-diameter simulation facility at the Lewis Research Center. Author

N79-24033*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARGING RATES OF METAL-DIELECTRIC STRUCTURES
Carolyn K. Purvis, John V. Staskus, James C. Roche, and Frank

D. Berkopec *In its* Spacecraft Charging Technol., 1978 1979 p 507-523 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Metal plates partially covered by 0.01-centimeter-thick fluorinated ethylene-propylene (FEP) Teflon were charged in the Lewis Research Center's geomagnetic substorm simulation facility using 5-, 8-, 10-, and 12-kilovolt electron beams. Surface voltage as a function of time was measured for various initial conditions (Teflon discharged or precharged) with the metal plate grounded or floating. Results indicate that both the charging rates and the levels to which the samples become charged are influenced by the geometry and initial charge state of the insulating surfaces. The experiments are described and the results are presented and discussed. NASA charging analyzer program (NASCAP) models of the experiments have been generated, and the predictions obtained are described. Implications of the study results for spacecraft are discussed. Author

N79-24034*# General Electric Co., Evendale, Ohio. Space Div.
MATERIALS AND TECHNIQUES FOR SPACECRAFT STATIC CHARGE CONTROL 2
R. E. Schmidt and A. E. Eagles *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 524-553 (For primary document see N79-24001 15-18)
(Contracts F33615-76-C-5075; F33615-76-C-5258)
Avail: NTIS HC A99/MF A01 CSCL 22B

Results of exploratory development on the design, fabrication and testing of transparent conductive coatings, conductive bulk materials and grounding techniques for application to high resistivity spacecraft dielectric materials to obtain control of static charge buildup are presented. Deposition techniques for application of indium oxide, indium/tin oxide and other metal oxide films on Kapton, FEP Teflon, OSR and solar cell coverglasses discussed include RF and Magnetron sputtering and vapor deposition. Development, fabrication and testing of conductive glass tiles for OSR and solar cell coverglass applications is discussed. Several grounding techniques for rapid charge dissipation from the conductively coated polymer and glass dielectrics which were developed and tested in thermal cycled and electron plasma environments are described. The optical and electrical characterization and aging effects of these coatings, bulk materials and grounding techniques are reviewed as they apply to the performance of their design functions in a geosynchronous orbit environment. A.R.H.

N79-24035*# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTRIC FIELDS IN IRRADIATED DIELECTRICS
A. R. Frederickson *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 554-569 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

An existing model for quantitatively predicting electric field build-up in dielectrics is used to demonstrate the importance of material parameters. Results indicate that electron irradiation will produce 10 to the 6th power V/cm in important materials. Parameters which can alter this build-up are discussed. Comparison to known irradiation induced dielectric charging experiments is discussed. Author

N79-24036*# European Space Agency, Paris (France)
EFFECTS OF ELECTRON IRRADIATION ON LARGE INSULATING SURFACES USED FOR EUROPEAN COMMUNICATIONS SATELLITES
J. Reddy and B. E. H. Serene *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 570-586 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Samples of aluminized Kapton used for passive thermal control on the VHF shield and the antenna dish of ESA's OTS satellite and its derivatives were subjected to an incident electron beam of 25 keV and irradiated for 8 hours at room temperature and at -173 C under a vacuum of the 10 to the minus 6 th power torr. Visual observations during electron irradiation, measurements of leakage current and discharge characteristics, and material degradation following completion of irradiation are discussed. A.R.H.

N79-24037*# Mission Research Corp., Santa Barbara, Calif.
SKYNET SATELLITE ELECTRON PRECHARGING EXPERIMENTS
Victor A. J. vanLint, David A. Fromme, and Roger Stettner *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 587-605 refs (For primary document see N79-24001 15-18)
(Contract DNA001-77-C-0009)
Avail: NTIS HC A99/MF A01 CSCL 22B

Large surface areas (approximately 1 sq m) of the Skynet I qualification model satellite were exposed to the environments of a flux of monoenergetic electrons and pulsed high-intensity X-ray photons from an exploding-wire-radiator source, separately and simultaneously. Experiments were performed with both the cylindrical solar cell panels and the end thermal blanket exposed to these environments. The satellite was instrumented with fiber-optics isolated fast-response sensors capable of sensing and recording the time-varying electric fields and surface currents on the satellite. Spontaneous discharges of the two surfaces were characterized prior to measurements of the interaction of the system-generated electromagnetic pulse from the X-ray photon burst with the electron precharged surfaces. A two-dimensional self-consistent finite difference computer code was used to predict the currents on the Skynet both with and without precharging of the thermal-blanket. These calculations, which used an thermal-blanket voltage profile, predicted a factor of 2 increase in satellite exterior axial currents. A.R.H.

N79-24038*# Pennsylvania State Univ., University Park.
POTENTIAL MAPPING WITH CHARGED-PARTICLE BEAMS
James W. Robinson and David G. Tillery *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 606-620 refs (For primary document see N79-24001 15-18)
(Grant NsG-3166)
Avail: NTIS HC A99/MF A01 CSCL 22B

Experimental methods of mapping the equipotential surfaces near some structure of interest rely on the detection of charged particles which have traversed the regions of interest and are detected remotely. One method is the measurement of ion energies for ions created at a point of interest and expelled from the region by the fields. The ion energy at the detector in eV corresponds to the potential where the ion was created. An ionizing beam forms the ions from background neutrals. The other method is to inject charged particles into the region of interest and to locate their exit points. A set of several trajectories becomes a data base for a systematic mapping technique. An iterative solution of a boundary value problem establishes concepts and limitations pertaining to the mapping problem. A.R.H.

N79-24039*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTROSTATIC DISCHARGE PROPERTIES OF SELECTED VOYAGER SPACECRAFT MATERIALS
J. B. Barengoltz, R. B. Greegor, II (Boeing Aerospace Co.), L. B. Fogdall (Boeing Aerospace Co.), and S. S. Cannaday (Boeing Aerospace Co.) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 621-631 refs (For primary document see N79-24001 15-18)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 22B

Twelve material and component samples were exposed to an electron beam in order to measure the time history and amplitude of resultant electrostatic discharges. The typical experimental design was to mount the test article with its dielectric surface facing the beam and its conductive portion isolated from ground except by way of a shielded cable on which a discharged pulse could be observed. The behavior of the sample was then observed at bombarding energies from 20 to 100 keV in increasing 20 keV increments and then 90 to 30 keV in decreasing 20 keV increments. Observations were made at each energy for nominally two hours at an electron flux of 4 x 10 to the 9th power/sq cm/sec. A.R.H.

N79-24040*# Colorado State Univ., Fort Collins.
CHARACTERIZATION OF ELECTRICAL DISCHARGES ON TEFLON DIELECTRICS USED AS SPACECRAFT THERMAL CONTROL
E. J. Yadlowsky, R. C. Hazelton, and R. J. Churchill *In* NASA.

Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 632-645 refs (For primary document see N79-24001 15-18) (Grant NsG-3145)
Avail: NTIS HC A99/MF A01 CSCL 22B

The dual effects of system degradation and reduced life of synchronous-orbit satellites as a result of differential spacecraft charging underscore the need for a clearer understanding of the prevailing electrical discharge phenomena. In a laboratory simulation, the electrical discharge current, surface voltage, emitted particle fluxes, and photo-emission associated with discharge events on electron beam irradiated silver-backed Teflon samples were measured. Sample surface damage was examined with optical and electron beam microscopes. The results are suggestive of a model in which the entire sample surface is discharged by lateral sub-surface currents flowing from a charge deposition layer through a localized discharge channel to the back surface of the sample. The associated return current pulse appears to have a duration which may be a signature by which different discharge processes may be characterized. A.R.H.

N79-24041*# Toronto Univ. (Ontario).
SCALING LAWS AND EDGE EFFECTS FOR POLYMER SURFACE DISCHARGES
Keith G. Balmain *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 646-656 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Specimens of Mylar sheet were exposed to a 20 kV electron beam. The resulting surface discharge arcs were photographed and the discharge current into a metal backing plate measured as a function of time. The area of the Mylar sheet was defined by a round aperture in a close-fitting metal mask, and the current pulse characteristics were plotted against area on log-log paper. The plots appear as straight lines (due to power-law behavior) with slopes of 0.50 for the peak current, 1.00 for the charge released, 1.49 for the energy and 0.55 for the pulse duration. Evidence is presented for the occurrence of banded charge distributions near grounded edges, on both Teflon and Mylar.
Author

N79-24042*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
THERMAL BLANKET METALLIC FILM GROUNDSTRAP AND SECOND SURFACE MIRROR VULNERABILITY TO ARC DISCHARGES
G. T. Inouye, N. L. Sanders, G. K. Komatsu, J. R. Valles, and J. M. Sellen, Jr. *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 657-681 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Available data on the geosynchronous orbit energetic plasma environment were examined, and a crude model was generated to permit an estimation to be made of the number of arc discharges per year to which a thermal blanket groundstrap would be subjected. Laboratory experiments and a survey of the literature on arc discharge characteristics were performed to define typical and worst case arc discharge current waveforms. In-air tests of different groundstrap configurations to a standardized test pulse were performed and a wide variability of durability values were found. A groundstrap technique, not used thus far, was found to be far superior than the others. S.E.S.

N79-24043*# European Space Research and Technology Center, Noordwijk (Netherlands).
INVESTIGATION OF ELECTROSTATIC DISCHARGE PHENOMENA ON CONDUCTIVE AND NON-CONDUCTIVE SOLAR REFLECTORS
S. J. Bosma, C. F. Minier, and L. Levy (Department d'Etudes et de Rechearches en Technologie Spatiale) *In* NASA. Lewis Res. Center Spacecraft Charging Technol. 1979 p 682-703 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A sample composed of non conductive optical solar reflectors (OSR) was irradiated with low energy electrons at the DERTS facility to study the effects of charge build up on thermal control coating materials. The degration effects on this panel due to electrostatic discharges were investigated to find possible alternatives to limit the amount of damage. The following systems are evaluated: (1) non conductive OSR (non conductive adhesive) (2) non conductive OSR (conductive adhesive); and conductive OSR (conductive adhesive). S.E.S.

N79-24044*# JAYCOR, Del Mar, Calif.
MODEL FOR BREAKDOWN PROCESS IN DIELECTRIC DISCHARGES
Roland Leadon and Jason Wilkenfeld (IRT Corp.) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 704-710 refs Sponsored in part by DNA and SAMSO (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A heuristic model to explain the blowoff of charge during an electron-induced dielectric discharge is presented. It is proposed that blowoff of charge is initiated by a punchthrough or a flashover. The discharge time is assumed to be governed by an LC time constant where L is the inductance of the electrons flowing in the branches of the Lichtenberg figures at an electron range below the irradiated surface and C is the capacitance between the trapped electrons and the substrate for the discharged area. Experiments to verify that blowoff is a consequence of punch-through or flashover and to measure the punchthrough current and the variation of discharge time with the sample area and thickness were conducted. S.E.S.

N79-24045*# Grumman Aerospace Corp., Bethpage, N.Y.
PARAMETER DEPENDENCE OF EQUILIBRIUM CHARGING POTENTIALS
Paul K. Suh and Michael C. Stauber *In* NASA Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 711-733 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Equilibrium surface potentials for slab configurations (representative e.g. of a large solar power satellite) are determined under extensive parametric variations of materials, solar exposure and substorm characteristics. The dependence of the charging process for dielectric surfaces on the various material response characteristics is described. The results are used as a guide to the material selection and design of large space systems to minimize dielectric breakdowns and reduce parasitic leakage currents on SPS. S.E.S.

N79-24046*# Pennsylvania State Univ., University Park.
STABLE DIELECTRIC CHARGE DISTRIBUTIONS FROM FIELD ENHANCEMENT OF SECONDARY MISSION
James W. Robinson *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 734-746 refs (For primary document see N79-24001 15-18)
(Grant NsG-3097)
Avail: NTIS HC A99/MF A01 CSCL 22B

The emission of secondary electrons from dielectrics subject tc numerous effects of electric field which are experimentally difficult to control is discussed. Measurements are reported using pulse techniques such that local fields do not build to significant levels, but measurements with fields present are also of interest. A specific series of measurements under controlled conditions are described and their implications in terms of fields, magnitude and angle, near the dielectric surface were examined. The measurements were made for a charged fluorinated-ethylene-propylene surface near a grounded aluminum half-round resting on the surface. The geometry produced a stable surface-charge gradient being controlled by a strongly enhanced secondary emission for which a model is constructed. Observations of surface flashovers under various conditions confirm the predictions of some scaling exercises. S.E.S.

N79-24047*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SECONDARY EMISSION EFFECTS ON SPACECRAFT CHARGING: ENERGY DISTRIBUTION CONSIDERATIONS
N. L. Sanders and G. T. Inouye *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 747-755 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The conditions under which multiple valued solutions occur by computing the floating potential of an isolated eclipses surface on a geosynchronous orbit spacecraft were examined. Different approximations for the electron spectra during a geomagnetic

substorm were used. The result indicates that if the incident electron flux has a Maxwellian energy distribution, the ratio of the secondary emitted current to the incident electron current is independent of the spacecraft potential. In this case a single value solution to the current equation occurs. S.E.S.

N79-24048*# Rockwell International Corp., Downey, Calif.
SECONDARY ELECTRON EFFECTS ON SPACECRAFT CHARGING
J. W. Haffner *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 756-768 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Calculations were conducted to determine the effects of electron-produced secondary electrons on the net charging current and the equilibrium voltage of spacecraft surfaces immersed in hot (keV) plasmas. The effects of secondary electrons produced by the primary plasma electrons were examined for aluminum, Teflon, Mylar, and Kapton. The results indicate that it is the primary electron energy region over which the secondary electrons are emitted (rather than the ratio of secondary to primary electrons) which determines the effectiveness of the secondary electrons in limiting the net charging current. While the electron-produced secondary electrons decreased the charging current, they had little effect upon the equilibrium voltages attained. S.E.S.

N79-24049*# Hiram Coll., Ohio.
GEOSYNCHRONOUS SATELLITE OPERATING ANOMALIES CAUSED BY INTERACTION WITH THE LOCAL SPACECRAFT ENVIRONMENT
Michael A. Grajek and Donald A. McPherson (Science Applications, Inc.) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 769-782 refs (For primary document see N79-24001 15-18)
(Contracts NAS3-21048; F04071-77-C-0166)
Avail: NTIS HC A99/MF A01 CSCL 22B

The dependence of a spacecraft anomaly or event upon geophysical parameters established on the basis of statistical analysis is presented. Examples are provided for establishing relationships between events and parameters such as geomagnetic activity, local time, and events on other spacecraft. Examples illustrated the potential dangers of not using quantitative statistical techniques it was recommended that the data collection planning and statistical analysis planning be done together. Results demonstrate a high correlation between the events and the geophysical parameter being investigated. S.E.S.

N79-24050*# Science Applications, Inc., La Jolla, Calif.
SPACECRAFT CHARGING STANDARD
Alan B. Holman and Maurice H. Bunn (SAMSO) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 783-796 (For primary document see N79-24001 15-18)
(Contract F04701-77-C-0166)
Avail: NTIS HC A99/MF A01 CSCL 22B

The spacecraft charging protection requirements for space vehicles which are to operate in the magnetospheric plasma environment are presented. M.M.M.

N79-24051*# Science Applications, Inc., La Jolla, Calif.
SPACECRAFT CHARGING MODELING DEVELOPMENT AND VALIDATION STUDY
E. E. ODonnell *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 797-816 refs (For primary document see N79-24001 15-18)
(Contracts NAS3-21048; F04701-77-C-0166)
Avail: NTIS HC A99/MF A01 CSCL 22B

The effects of spacecraft charging are presented. Analytical models of the magnetospheric environment are used to show the charging interaction between the spacecraft and the plasma sheath, the discharge phenomena, and electromagnetic coupling from the discharge to spacecraft components. Ground tests to validate the models are described. M.M.M.

N79-24052*# European Space Agency, Paris (France).
THE QUALIFICATION OF A LARGE ELECTRON IRRADIATION FACILITY FOR TELECOMMUNICATION SATELLITE DIFFERENTIAL CHARGING SIMULATION
B. E. H. Serene and J. Reddy *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 819-833 (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The definition and procurement program is presented for the set up of a test simulating an electron environment on a model of a communication satellite to study the degradation of the thermal insulation materials during electron bombardment. M.M.M.

N79-24053*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
TDRSS SOLAR ARRAY ARC DISCHARGE TESTS
G. T. Inouye and J. M. Sellen, Jr. *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 834-852 refs (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Solar array design guidelines for immunity to the geomagnetic substorm environment at geosynchronous altitudes are summarized. The preliminary design guidelines and recommended practices based on these test results are given. It is concluded that specific design and immunity verification problems on each spacecraft program have to be solved on an individual basis until the technology matures to an adequate level. M.M.M.

N79-24054*# Spire Corp., Bedford, Mass.
A COMBINED SPACECRAFT CHARGING AND PULSED X-RAY SIMULATION FACILITY
Steven H. Face, Michael J. Nowlan, William R. Neal, and William A. Seidler *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 854-867 refs Sponsored by DNA (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A spacecraft charging simulation facility constructed to investigate the response of satellite materials in a typical geomagnetic substorm environment is described. The conditions simulated include vacuum, solar radiation, and substorm electrons. A nuclear threat environment simulation using a flash X ray generator is combined with the spacecraft charging facility. Results obtained on a solar cell array segment used for a preliminary facility demonstration are presented with a description of the facility. M.M.M.

N79-24055*# SRI International Corp., Menlo Park, Calif.
CHARACTERIZATION OF ELECTROMAGNETIC SIGNALS GENERATED BY ELECTRICAL BREAKDOWN OF SPACECRAFT INSULATING MATERIALS
J. E. Nanevicz, R. C. Adamo, and B. L. Beers (Science Applications, Inc.) *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 868-875 (For primary document see N79-24001 15-18)
(Contract F49620-77-C-0113)
Avail: NTIS HC A99/MF A01 CSCL 22B

The functioning of the experimental setup and the preliminary inputs for the development of analytical models of the discharge process are presented. This allows for the development of new or modified materials and design techniques having the necessary discharge immunity to insure high reliability and long lifetime of space systems. M.M.M.

N79-24056*# SRI International Corp., Menlo Park, Calif.
DEVELOPMENT OF THE TRANSIENT PULSE MONITOR (TPM) FOR SCATHA/P78-2
R. C. Adamo, J. E. Nanevicz, and G. R. Hilbers *In* NASA. Lewis Res. Center Spacecraft Charging Technol., 1978 1979 p 876-880 (For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

An instrumentation system developed for the detection of electrical transients on space vehicles is presented. The pulse monitor measures the electron pulse environment on a spacecraft at synchronous altitude, and characterizes signals produced by arcing between differentially charged elements on the spacecraft. M.M.M.

N79-24057*# SRI International Corp., Menlo Park, Calif.
FURTHER DEVELOPMENT OF THE MULTIPACTOR DISCHARGE ELECTRON SOURCE
J. E. Nanevicz and R. C. Adamo *In* NASA. Lewis Res. Center

Spacecraft Charging Technol., 1978 1979 p 881-886 ref
(For primary document see N79-24001 15-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A modification to the multipactor electron source used in the study of the behavior of spacecraft insulating materials is described. The electron accelerating system was included within the source, freeing the region between the source and the target of fields produced by the source electrodes. M.M.M.

N79-24058# Prototype Development Associates, Inc., Santa Ana, Calif.
FLAME NOSETIP RECOVERY VEHICLE FLIGHT TEST SERIES Final Report, Jul. 1975 - Mar. 1977
David H. Smith Jun. 1978 91 p refs
(Contract DNA001-74-C-0295)
(AD-A066217; AD-E300453; PDA-TR-1027-00-01; DNA-4654F) Avail: NTIS HC A05/MF A01 CSCL 16/3

The FLAME payload was designed to recover reentry vehicle nosetips after subjecting them to ICBM-level reentry environments. The payload is a two-stage solid propellant rocket fired towards the earth, after being dropped from an F4 aircraft at 60,000 feet. The payload employs a unique two-stage hypersonic decelerator system for nosetip recovery. A total of eight flight tests were performed. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-24059# Missouri Univ. -Rolla. Dept. of Physics.
KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES Final Report, 1 Mar. 1974 - 30 Sep. 1978
K. J. Nygaard, L. D. Schearer, and W. R. Snow Nov. 1978 32 p refs
(Grant AF-AFOSR-2672-74; AF Proj. 2308)
(AD-A065646; AFOSR-79-0196TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

Pergament and Jensen recently have developed a model for estimating the densities of neutral and charged species for an afterburning plume of a solid fuel rocket as a function of distance along the plume. They have compared the predicted electron densities with experimental radar cross section measurements of electron density and find agreement at least within an order of magnitude. The predictions of the model are dependent on the accuracy with which the rate constants used are known. This report describes the work done under AFOSR 74-2672 toward rate constant measurements for those reactions that Pergament and Jensen pointed out as critical to the model and poorly known; dissociative attachment of electrons in HCl, collisional ionization of potassium and chlorine, and three body recombination of potassium. The reactions are closely related in the rocket plume, but diverse experimental procedures are required to measure the rates of the reactions. Potassium is a contaminant of the perchlorate oxidizer in some solid fuels, but because of its low ionization potential, it can make an inordinately large contribution to ionization in the plume. Author (GRA)

N79-24060# Technion, Inc., Irvine, Calif.
MECHANISMS OF MAGNETOPLASMADYNAMIC ARCJET ACCELERATION PROCESSES Final Report, 15 Oct. 1973 - 30 Aug. 1978
Gordon L. Cann and Adriano C. Ducati Dec. 1978 108 p refs
(Contract F44620-74-C-0017; AF Proj. 2308)
(AD-A065617; AFOSR-79-0180TR) Avail: NTIS HC A06/MF A01 CSCL 21/3

Investigations into methods of utilizing ambient gas as propellant at satellite altitudes have been experimentally and analytically investigated. As part of this investigation, a class of space charge limited plasma accelerators has been studied. Experimentally, discharges in these devices are low current (.1 amp to 2 amps) and high voltage (200v to 10,000v). Ions are produced by electron bombardment of the adsorbed gases on the anode. Treating the flow of ions and electrons as a conducting fluid permits analogies with fluid flow phenomena. Sub- and supercritical flow for both ions and electrons correspond to subsonic and supersonic flow in a fluid. In one-dimensional flow, the electric field creates an electrostatic nozzle with critical flow occurring where the electric field is zero (the electrostatic throat). A rigorous analysis of the flow gives qualitative agreement with measured discharge characteristics. Space charge buildup limits the ratio of beam power to electric power input to under 1% for the operating mode wherein ions are produced from the adsorbed gas on the anode. Conventional performance as a pulsed plasma accelerator can be obtained by desorbing the gas from the anode rapidly so that breakdown occurs. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-24061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POLYIMIDE PREPREG MATERIAL HAVING IMPROVED TACK RETENTION Patent Application
T. T. Serafini and P. Delvigs, inventors (to NASA) Filed 6 Apr. 1979 10 p
(NASA-Case-LEW-12933-1; US-Patent-Appl-SN-027557) Avail: NTIS HC A02/MF A01 CSCL 07C

A composition, of the type disclosed in U.S. Patent 3,745,149 and which includes a polyfunctional ester, a polyfunctional amine, and an end-capping agent, is impregnated into fibers or fabric and heated to form prepreg material. The tack retention characteristics of this prepreg material are improved by incorporating into the composition a liquid olefinic material compatible with the other ingredients of the composition. The prepreg material is heated at a higher temperature to effect formation of the polyimide resin and the monomeric additive is incorporated in the polyimide polymer structure. NASA

24 COMPOSITE MATERIALS

Includes laminates.

N79-24062* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIBROUS REFRACTORY COMPOSITE INSULATION Patent
Daniel B. Leiser (Stanford Univ., Calif.), Howard E. Goldstein (Stanford Univ., Calif.), and Marnell Smith, inventors (to NASA) (Stanford Univ., Calif.) Issued 10 Apr. 1979 5 p Filed 8 Sep. 1978 Supersedes N78-32189 (16 - 23, p 3052) Sponsored by NASA
(NASA-Case-ARC-11169-1; US-Patent-4,148,962; US-Patent-Appl-SN-940688; US-Patent-Class-428-366) Avail: US Patent and Trademark Office CSCL 11D

A refractory composite insulating material was prepared from silica fibers and aluminosilicate fibers in a weight ratio ranging

from 1:19 to 19:1, and about 0.5 to 30% boron oxide, based on the total fiber weight. The aluminosilicate fiber and boron oxide requirements may be satisfied by using aluminoborosilicate fibers and, in such instances, additional free boron oxide may be incorporated in the mix up to the 30% limit. Small quantities of refractory opacifiers, such as silicon carbide, may be also added. The composites just described are characterized by the absence of a nonfibrous matrix.

Official Gazette of the U.S. Patent and Trademark Office

N79-24063 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EVALUATION OF STIFFNESS REDUCTION AS A DAMAGE PARAMETER AND CRITERION FOR FATIGUE FAILURE IN COMPOSITE MATERIALS Ph.D. Thesis
Thomas Kevin OBrien 1978 124 p
Avail: Univ. Microfilms Order No. 7910486

The effect of size and type of strain measurement techniques on property measurements and observed reductions were documented. Complete characterization of all the in-plane engineering moduli on a single laminate was achieved using a combination of longitudinal, transverse, shear, and flexure tests. Repeatability of the various measurements were documented. Reductions in engineering moduli for several boron epoxy laminates indicated a relatively homogeneous, isotropic state of damage resulting from fatigue loading. A secant modulus criterion for predicting maximum percentage degradation in the load direction modulus of various laminates subjected to fatigue loading was evaluated. The dependence of fiber dominated laminate material response on the stress level in the zero degree plies was noted. Dissert. Abstr.

N79-24064 British Library Lending Div., Boston Spa (England).
COMPOSITE MATERIALS WITH SUPERPLASTIC MATRIX
A. S. Tikhonov, M. Kh. Shorshorov, L. V. Katinova, V. P. Shamtsyan, and V. P. Pochkai May 1979 6 p ref Transl. into ENGLISH from Voloknistnye i Dispersnouprochennye Kompozitsionnye Materialy (USSR) p 132-135
(BLL-RTS-11722) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A superplasticity effect is used to produce thin matrix foils (10-20 use micrometers thick) and composites themselves by conventional forming methods. A silumin casting alloy (Al + 11 percent Si) as the matrix material, composites were formed from plasma preforms obtained by atomisation of silumin wire onto boron fibres, and by hot rolling methods of vacuum pressing in conditions which ensured mainfestation of the matrix superplasticity effect. The hot rolling was carried out in air using a 300 duo mill at 450 C in the direction transverse to the direction of the fibres. Before rolling the pack of single-layer preforms the composites were soaked in a furnace at 450 deg C for 30 min. Investigations show that the strength of the composite increases with increasing reduction of the packet. It reached 76 kgf sq mm at 80% reduction with the boron fibre content at 35 vol. percent. A.R.H.

N79-24065*# National Aeronautics and Space Administration, Washington, D. C.
CRACK BARRIERS IMPROVE THE MECHANICAL AND THERMAL PROPERTIES OF NON-METALLIC SINTER MATERIALS
K. H. Gruenthaler, W. Heinrich, S. Janes, and J. Nixdorf Apr. 1979 16 p refs Transl. into ENGLISH from 8th Plansee Seminar (Austria), v. 3, 1974 18 p Presented at the 8th Plansee Seminar, Rente, Austria, 27-30 May 1974 Original language document announced as A77-36098 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc, Prepared by Battelle Inst. e.V., Frankfurt am Main, West Germany
(Contract NASw-3198)
(NASA-TM-75426) Avail: NTIS HC A02/MF A01 CSCL 11D

Means of improving the tensile strength of ceramic composites by introducing ductile intermediate layers capable of absorbing the elastic energy at the rupture front are studied. Tests with an Al203 laminate with niobium inclusions showed that crack propagation could be successfully precluded by dissipation of the energy by deformation and/or delamination at the inclusion/matrix interface. Author

N79-24066*# Boeing Aerospace Co., Seattle, Wash.
DESIGN FABRICATION AND TEST OF GRAPHITE/POLYIMIDE COMPOSITE JOINTS AND ATTACHMENTS FOR ADVANCED AEROSPACE VEHICLES Quarterly Technical Progress Report, 15 Jan. 1979
15 Apr. 1979 41 p refs
(Contract NAS1-15644)
(NASA-CR-159080; QTPR-1) Avail: NTIS HC A03/MF A01 CSCL 11D

Graphite/polyimide (Gr/PI) bolted and bonded joints were investigated. Possible failure modes and the design loads for the four generic joint types are discussed. Preliminary sizing of a type 1 joint, bonded and bolted configuration is described, including assumptions regarding material properties and sizing methodology. A general purpose finite element computer code is described that was formulated to analyze single and double lap joints, with and without tapered adherends, and with user-controlled variable element size arrangements. An initial order of Celion 6000/PMR-15 prepreg was received and characterized. J.M.S.

N79-24067*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
INVESTIGATION AND CHARACTERIZATION OF CONSTRAINT EFFECTS ON FLAW GROWTH DURING FATIGUE LOADING OF COMPOSITE MATERIALS Final Report, 1 Dec. 1976 - 31 Mar. 1979
W. W. Stinchcomb, K. L. Reifsnider, P. Yeung, and M. N. Gibbins Jun. 1979 82 p refs
(Grant NsG-1364)
(NASA-CR-158659) Avail: NTIS HC A05/MF A01 CSCL 11D

An investigative program is presented in an attempt to add to the current understanding of constraint effects on the response of composite materials under cyclic loading. The objectives were: (1) to use existing data and to develop additional data in order to establish an understanding and quantitative description of flaw growth in unidirectional lamina under cyclic loading at different load direction to fiber direction angles; (2) to establish a similar understanding and description of flaw growth in lamina which are embedded in laminates between other unflawed lamina; (3) to determine the nature of the influence of constraint on flaw growth by quantitatively comparing the results of the tests; and (4) to develop a model and philosophy of constraints effects based on our investigative results. J.A.M.

N79-24068# Chemical Engineering Research Group, Pretoria (South Africa).
HIGH SURFACE AREA AMORPHOUS SILICA-ALUMINA CRACKING CATALYSTS WITH CONTROLLED SITE SPACINGS M.S. Thesis - South Africa Univ.
M. R. S. Manton Feb. 1978 66 p refs
(CSIR-CENG-232; ISBN-0-7988-1314-8) Avail: NTIS HC A04/MF A01

The effect of tetraalkyl ammonium cation during co-gelation on the catalytic site distribution in amorphous silica-alumina catalysts is presented, as well as the selectivities or rates of deactivation of the catalysts during catalytic cracking. M.M.M.

N79-24069# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
EFFECT OF HIGH LOAD ON THE FATIGUE BEHAVIOR OF UNNOTCHED GRAPHITE/EPOXY LAMINATES Final Report, Jun. 1977 - May 1978
J. N. Yang (George Washington Univ.) Nov. 1978 53 p refs
(Contract F33615-77-C-5123)
(AD-A065631; AFML-TR-78-147) Avail: NTIS HC A04/MF A01 CSCL 11/4

The purpose of this research program is to verify experimentally the theoretical prediction for the effect of the high load on the fatigue behavior of unnotched composite laminates. A three-parameter fatigue and residual strength degradation model has been used to derive the number of load cycles a specimen can survive and the statistical distributions of the fatigue life and the residual strength after the specimen has survived an initial high load or periodic high loads. One set of the static ultimate strength data and one set of the fatigue scan data

were generated to determine the three-parameter values appearing in the theoretical model. GRA

N79-24070# Army Materials and Mechanics Research Center, Watertown, Mass.
THE POTENTIAL FOR ACCIDENTAL RELEASE OF CARBON/GRAPHITE FIBERS FROM RESIN MATRIX COMPOSITES AS DETERMINED BY THERMOGRAVIMETRIC ANALYSIS Final Report
Stanley E. Wentworth, Abram O. King, and Richard J. Shuford Jan. 1979 27 p
(DA Proj. 1L6-62618-AH-80)
(AD-A065962; AMMRC-TR-79-1) Avail: NTIS HC A03/MF A01 CSCL 11/5

Recently, there has been concern over the effects of accidentally released conductive carbon and graphite fibers on unprotected electrical circuits. Since involvement in fire would be the principal means of release of these fibers from resin matrix composites, the thermal oxidative behavior of such materials became a matter of interest. Thus, a series of dynamic and isothermal thermogravimetric analyses was performed on a variety of state-of-the-art materials. The dynamic analyses (10 C/min, flowing air) indicated the temperatures at which the resin matrices and fibers experienced the onset of degradation. Isothermal analyses at 400 C and 500 C in flowing air were used to determine the time at temperature required to generate releasable fibers. Microscopy was used to examine the residues in order to characterize their physical state. It was concluded that the potential for accidental release varied inversely with the thermal stability of the resin matrix and directly with that of the fiber. Author (GRA)

N79-24071# Ball Bros. Research Corp., Boulder, Colo. Aerospace Systems Div.
OUTGASSING TESTS OF FIBER-EPOXY COMPOSITE MATERIALS
H. C. Poehlmann Feb. 1979 48 p
(Contract EY-76-C-04-0789)
(SAND-78-7075) Avail: NTIS HC A03/MF A01

Twelve throughput-type outgassing tests were performed on samples of six different fiber-epoxy composite materials that are of prospective use in energy-storage flywheels. One set of tests was run with the material samples at room ambient temperatures (about 30 C) while the other set was run with the samples at 66 C. The test equipment used and the test results are discussed. DOE

N79-24072 This accession not used.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N79-24073* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ELECTROCHEMICAL DETECTION DEVICE Patent
Richard N. Young and Judd R. Wilkins, inventors (to NASA) Issued 17 Apr. 1979 5 p Filed 30 Nov. 1977 Supersedes N78-17171 (16 - 08 p 0994)
(NASA-Case-LAR-11922-1; US-Patent-4,149,938; US-Patent-Appl-SN-856460; US-Patent-Class-195-127; US-Patent-Class-204-195B) Avail: US Patent and Trademark Office CSCL 07D

A standard pH reference electrode and a platinum cathodic electrode are positioned in a container with suitable nutrient medium for microbial growth plus the sample to be tested. The two electrodes are connected to electronic circuitry including an up/down counter which counts up for the first 80 minutes after a test has initiated. Then the potential between the two electrodes is tracked by the electronic circuitry and after there is a change of 10 mv a signal is sent to the up/down counter to cause it to reverse its count. When there is a additional 20 mv change in the potential between the two electrodes another signal is sent to the up/down counter, signalling it to stop. The resulting count on the counter is equal to the length of time for the inoculum to begin the production of measurable amounts of H2 after inoculation.

Official Gazette of the U.S. Patent and Trademark Office

N79-24074 British Library Lending Div., Boston Spa (England).
SOME PHYSICAL AND CHEMICAL PROPERTIES OF SODIUM-ALUMINATE SOLUTIONS
Jozsef Weber Mar. 1979 11 p refs Transl. into ENGLISH from Banyasz. Kohasz. Lapok, Kohasz. (Hungary), v. 109, no. 3, 1976 p 127-133
(BLL-RTS-11347) Avail: British Library Lending Div., Boston Spa, Engl.

The paper discusses the density of sodium hydroxide and sodium aluminate solutions used in alumina production and the regression equations expressing the changes in density, the molar volume and specific electrical conductivity of the solutions. The specific electrical conductivity of the slurries consisting of a sodium - aluminate solution and dry red mud. Author

N79-24075 Kansas Univ., Lawrence.
HIGH TEMPERATURE THERMODYNAMICS AND VAPORIZATION OF THE ZIRCONIUM-NIOBIUM-OXYGEN SYSTEM Ph.D. Thesis
Gary Howard Rinehart 1978 410 p
Avail: Univ. Microfilms Order No. 7910582

The vaporization behavior of the Zr-Nb-O system was studied by means of successive vaporization, Knudsen effusion-target collection experiments, and mass spectrometric analysis of the vapors effusing from a Knudsen crucible. The successive vaporization experiments were performed on two ternary samples in open crucibles. X-ray powder diffraction patterns of the residues and x-ray fluorescence analysis of the condensates and residues indicated the preferential vaporization of niobium-containing species with the composition of the residue subsequently becoming closer to that of congruently vaporizing ZrO2-x. Dissert. Abstr.

N79-24076 Cornell Univ., Ithaca, N. Y.
MOLECULAR ORBITAL STUDIES OF BONDING AND REACTIVITY IN ORGANOMETALLIC TRANSITION METAL COMPLEXES AND CLUSTER COMPOUNDS Ph.D. Thesis
Brigitte E. R. Schilling 1979 235 p
Avail: Univ. Microfilms Order No. 7910834

The electronic and geometrical properties of organometallic transition metal complexes are examined. Extended Huckel calculations were performed and symmetry argument applied to aid in the understanding of the bonding and reactivity. An understanding of the variable location of hydrogens in these clusters was provided. Dissert. Abstr.

N79-24077 Vanderbilt Univ., Nashville, Tenn.
STUDIES IN THE THEORY AND PRACTICES OF FOAM FLOTATION TECHNIQUES Ph.D. Thesis
Ben Lewis Currin 1978 125 p
Avail: Univ. Microfilms Order No. 7909268

Basic principles and applications of foam separation techniques are discussed. High concentrations of copper(II) are removed from aqueous systems by precipitating most of the copper and then treating with adsorbing colloid flotation. Statistical mechanical methods are used to examine the displacement of

surfactants from floc-water interfaces by salts. The factors studied are: binding energies of surfactant and nonsurfactant ions to the floc surface, concentration of nonsurfactant ion, energy of interaction between hydrocarbon chains, and temperature. Surfactant condensed films can be displaced from flocs, greatly improving the economics of adsorbing colloid flotation techniques. Dissert. Abstr.

N79-24078 Cornell Univ., Ithaca, N. Y.
A SEMIEMPIRICAL APPROACH FOR RESONANCE RAMAN INTENSITIES Ph.D. Thesis
Gerald Michael Korenowski 1979 191 p
Avail: Univ. Microfilms Order No. 7910757

This semiempirical method described is advantageous when the scattering molecules are in the condensed phase. In the summation over states for an inresonance electronic state, the summation over the Raman active vibration and its Raman Franck-Condon factors are separated out of the expression for the polarizability tensor component and the remaining summation is left to become an integration with the remaining transition probabilities represented by a transition probability distribution function (TPD). The TPD function parameters and potential well displacement for the Raman vibration are obtained by best-fitting the absorption band of the resonant electronic state. After calculation of the Raman Franck-Condon factors, the resonance contributions to the Raman scattering cross section are calculated by a summation and integration. Ensemble broadening effects upon absorption bands and resonance Raman profiles are also discussed. Dissert. Abstr.

N79-24079 Harvard Univ., Cambridge, Mass.
SPECTROSCOPIC INVESTIGATIONS OF METAL CATION REDUCTION AT GLASS SURFACES Ph.D. Thesis
Irene Greenwald Plotzker 1979 282 p
Avail: Univ. Microfilms Order No. 7909383

Reduction of metal oxide mataphosphate glasses is observed above ca. 100C when the glass is treated with one of several gaseous reducing agents such as H2, atomic hydrogen, Hg or K. Such amorphous systems are characterized by rapid cation diffusion with cation reduction occurring principally at the glass surface, which leads to metal cluster formation and eventual continuous metal film growth. The basic properties of the glasses are discussed. The temperature dependence of the intensity and frequency of a low energy mode in the Raman spectrum of glasses is discussed. Experimental conditions leading to metal cluster formation and film growth are detailed. Species produced by the reaction of NH3 with silver metaphosphate glass are characterized. A mechanism is proposed for the reaction. The effect of water vapor on increasing the reaction rate for the mercuric metaphosphate/hydrogen reaction is demonstrated. Dissert. Abstr.

N79-24080 Princeton Univ., N. J.
ENGINEERING IMPLICATIONS FOLLOWING THE ATTACHMENT OF CATALYTICALLY ACTIVE TRANSITION METAL COMPLEXES ONTO SOLID SUPPORTS THE LEAKY CATALYST Ph.D. Thesis
Howard Wayne Altmann 1979 404 p
Avail: Univ. Microfilms Order No. 7910100

A mathematical analysis is presented which described catalyst leaching in both single pellets and packed bed reactors. Orthogonal collocation was used to solve the single pellet problem since the governing differential equation was of the two-point boundary value type and additionally had variable coefficients. The packed bed analysis required the inversion of a Laplace transform. Successful solution utilized Longman's method, an averaging technique for obtaining the integral of an oscillatory function with decreasing peak areas. Dissert. Abstr.

N79-24081 Connecticut Univ., Storrs.
PHOTOACOUSTIC SPECTROSCOPY: ITS APPLICATION TO THE STUDY OF SOLID MATERIALS Ph.D. Thesis
Harry Edwin Eaton, Jr. 1978 159 p
Avail: Univ. Microfilms Order No. 7911365

An inexpensive, single beam photoacoustic spectrometer system is described. The system was designed to make the technique available to most laboratories. Expensive, commercial, data acquisition units are replaced by commonly available and easily constructed components. The problems associated with the single beam mode of operation (i.e., source output correction, background compensation, and temporal source variation) are accounted for by employing a microcomputer for data acquisition and reduction. Evaluation of the system is presented along with the spectra of Ho2O3, Er2O3, and Nd2O3. Resolution is approximately 15 nm while the standard sample size is 5 to 10 mg depending both on the analyte and its matrix. Dissert. Abstr.

N79-24082 Arizona Univ., Tucson.
SPECTROELECTROCHEMICAL STUDIES OF FAST REACTIONS Ph.D. Thesis
David Lee Langhus 1978 239 p
Avail: Univ. Microfilms Order No. 7909480

A method is developed for verifying the fit of linear potential sweep chronoamperometric (cyclic voltammetric) and potential step spectrochemical data obtained from a chemical reaction system to a postulated reaction mechanism. For cases where a satisfactory fit is achieved, certain kinetic, thermodynamic, and physical parameters are estimated, including homogeneous rate constants, equilibrium constants, and molar absorptivities of individual species. Theoretical response curves are obtained for both techniques from finite difference simulations implemented in a way that a wide range of parameter values are accepted for which external scaling is not required. Dissert. Abstr.

N79-24083 Colorado Univ. at Boulder.
DYNAMICS OF A CONTINUOUS THICKENER HANDLING A COMPRESSIBLE SLURRY Ph.D. Thesis
Theodore Motyka 1978 169 p
Avail: Univ. Microfilms Order No. 7911463

Laboratory continuous-thickener experiments were performed to verify the applicability of a theoretical, unsteady-state, mathematical model developed to describe the dynamic behavior of the continuous thickener operation. The basis of the model is an unsteady-state solids material balance on a vertical slice of the thickener coupled with throughput limitations obtained from the batch settling characteristics of the material employed. The settling material used was a zinc hydroxide-carbonate slurry. Continuous thickener experiments were carried out in which step changes in the feed concentration, feed flowrate, or underlow rate were introduced. Dissert. Abstr.

N79-24084 Tennessee Univ., Knoxville.
ANALYSIS OF A FRACTIONAL GAS STRIPPER Ph.D. Thesis
Michael Joe Stephenson 1978 197 p
Avail: Univ. Microfilms Order No. 7911716

The experimental and theoretical analysis of a fractional gas stripper with volatile solvent (CCl2F2) is described. An external gamma scanning device employing radioisotopes was developed that enabled direct measurement of packed column concentration profiles. A number of these operating scans are presented. A soluable gas concentration peak was found in all tests owing to gross internal column condensation and reflux of the stripping vapor. The height of the gas peak increased dramatically as the solvent condensation zone was positioned higher and more stripping stages became available in the lower part of the column. A fractional gas stripper model is presented based on the conventional two-film mass and heat transfer theory that allows for gross internal condensation of the stripping vapor and multicomponent mass transfer. Dissert. Abstr.

N79-24085 Clemson Univ., S.C.
A KINETIC STUDY OF THE REACTIONS OF BIPHENYL AND CHLORINE IN WATER TO FORM CHLOROBIPHENYLS Ph.D. Thesis
Eric Heinman Snider 1978 166 p
Avail: Univ. Microfilms Order No. 7909401

The reactions of biphenyl dissolved in water with aqueous chlorine to form chlorobiphenyls under a variety of conditions were studied. Biphenyls, used extensively in industry as a heat transfer medium and dye carrier, can react with chlorine used in waste treatment to form polychlorinated biphenyls. The reaction conditions studied were chosen to represent as closely as possible the environment of a waste treatment facility while still producing measurable product concentrations. The reactions were found to

produce two monochlorobiphenyls. Kinetics results led to rate expressions second order in undissociated hypochlorous acid concentration and first order in biphenyl concentration. Temperature studies of the reactions gave activation energies of 14.7 kcal/mol for ortho and 14.2 kcal/mol for para. Dissert. Abstr.

N79-24086 Notre Dame Univ., Ind.
ACTIVITY AND SELECTIVITY OF PLATINUM SINGLE CRYSTAL SURFACES AND SUPPORTED PLATINUM CATALYSTS FOR HYDROCARBON REACTIONS AT ATMOSPHERIC PRESSURE Ph.D. Thesis
Robert Eugene Polomski 1978 195 p
Avail: Univ. Microfilms Order No. 7908387

A well-known structure-sensitive reaction, cyclohexane dehydrogenation to benzene, was used as an initial test reaction. Using a neopentane hydrogenolysis-isomerization reaction, it was found that structure-sensitive behavior could be detected using single crystals of different surface orientation at atmospheric pressure conditions. A series of experiments were conducted using a platinum single crystal in alumina to hydrogenate cyclopropane to determine whether the physical pressure of alumina could have any effect on catalyst self-poisoning. A study was conducted to determine whether the alumina could be activated for cyclohexane dehydrogenation. A high temperature treatment was found necessary for the activation. Dissert. Abstr.

N79-24087 Texas A&M Univ., College Station.
PRESSURE-VOLUME-TEMPERATURE RELATIONS OF ETHANE, OF METHYL CHLORIDE AND OF THE EQUIMOLAR MIXTURE USING THE BURNETT-ISOCHORIC METHOD Ph.D. Thesis
Hamazasm Mansoorian 1978 209 p
Avail: Univ. Microfilms Order No. 7909218

The Burnett-isochoric method was employed for data procurement to minimize the effect of cumulative errors of adsorption. This method enabled coverage of an entire P(rho,T) surface with a single sample. Purity of the ethane sample was 99.99 mole percent while the methyl chloride was 99.97 + percent. The mixture was made inside the cell using the Hall-Eubank method and the composition was calculated without chemical analysis. A method was developed to estimate the magnitude of adsorption at the lower temperatures based upon information obtained from the Burnett-isochoric P-T grid. This method improved considerably the accuracy of data points near the coexistence curve. The Burnett-isochoric method also provided a means for accurate calculation of thermal properties. Intermodular force constants were obtained from second virial coefficients of the pure components. Dissert. Abstr.

N79-24088 West Virginia Univ., Morgantown.
MECHANISMS OF PARTICLE TRANSPORT AND ELECTROKINETIC PHENOMENA IN A CROSS FLOW/ELECTROFILTER Ph.D. Thesis
Chia-huei Alex Kuo 1978 430 p
Avail: Univ. Microfilms Order No. 7910901

Particle transport mechanisms in a cross flow/electrofilter (CF/EF) including convective mass transfer, radial migration and electrophoretic migration were used to minimize or eliminate the accumulation of particles at the filter surface and consequently, to improve the filtration rate. Electroosmosis in the filter medium or the filter cake, if one exists, can cause an increase in filtration rate. A mathematical model which included the effects or particle convective mass transfer, particle radial migration, electrophoresis and electroosmosis in terms of resistance to filtration was developed and utilized to interpret the experimental data that were obtained from the aqueous (Cr2O3/water and lay/water) and nonaqueous (Al2O3/methanol and Al2O3/butanol) systems. Dissert. Abstr.

N79-24089 California Inst. of Tech., Pasadena.
SELECTIVE TRANSPORT OF SULFUR-DIOXIDE THROUGH POLYMER MEMBRANES Ph.D. Thesis
Donald Leroy Kuehne 1978 214 p
Avail: Univ. Microfilms Order No. 7911627

The purpose of this research was to identify and characterize polymeric materials which are selective to SO2 for possible applications in the monitoring or control of SO2 emissions from stationary sources. Preliminary studies indicated that polyacrylate and cellulose triacetate were very selective to SO2. The SO2 solubility of polyacrylate was 0.215 lb/lb (25 C, 1 atm), comparable to the SO2 solubilities of sulfolane (tetrahydrothiophene-1,1-dioxide) and polyethylene glycol, two excellent SO2 solvents. To achieve the high SO2 transport rates required for a membrane separation process, two techniques were investigated for preparing ultrathin films of these polymers. Polyacrylate films were cast on mercury, and cellulose triacetate films were formed on glass plates which were withdrawn at constant velocity from dilute polymer solutions. The glass plate technique was also used to make composite films consisting of a 0.2-0.5 microns layer of polyacrylate over a 0.002-0.005 microns layer of cellulose triacetate. Dissert. Abstr.

N79-24090 Vanderbilt Univ., Nashville, Tenn.
AGITATED BATCH AND PACKED COLUMN ACTIVATED CARBON ADSORPTION Ph.D. Thesis
Ananth Seshadri Kodavasal 1978 236 p
Avail: Univ. Microfilms Order No. 7909278

Insight was gained into the various phenomena that are operative in the adsorption centers of activated carbon particles. Two separate mass transfer resistances, one in the external liquid-film and one residing in the porous solid, completely characterize the mass transfer occurring in both the batch and the column models of adsorption studied in the course of the present investigation. Batch studies were conducted in an agitated tank and the external transfer coefficient and the effective diffusivity for the porous particle are determined through the use of the appropriate mathematical models in conjunction with experimental concentration decay data. The results from the batch experiments were then utilized in predicting the performance of the unsteady-state column adsorption process. Dissert. Abstr.

N79-24091 Wayne State Univ., Detroit, Mich.
MASS TRANSFER AND KINETIC STUDIES ON ROTATING ELECTRODES Ph.D. Thesis
Jung Taek Kim 1978 219 p
Avail: Univ. Microfilms Order No. 7908933

Mass transfer and kinetics studies were performed using the limiting current technique for various electrochemical systems of practical importance. Rotating electrodes (disks or hemisphere) were used because the hydrodynamic conditions are well defined and easily controlled. The experimental work included two main areas: the zinc-chlorine battery and iron corrosion in acidified chloride solution. Dissert. Abstr.

N79-24092 Cornell Univ., Ithaca, N. Y.
THE KINETICS OF THE METHANATION OF CARBON MONOXIDE ON SILICA-SUPPORTED NICKEL CATALYSTS Ph.D. Thesis
Sa Van Ho 1979 184 p
Avail: Univ. Microfilms Order No. 7910812

The kinetics of the methanation of CO was studied over Cab-O-Sil-supported nickel catalysts in a fixed bed reactor at 200 to 410 C and 1 to 3 atm. total pressure, under steady state and transient conditions. Partial pressure of CO ranged from 0.005 atm. to 0.45 atm., and partial pressure of H2 ranged from 0.2 atm. to 2.9 atm. Catalysts with nickel contents of 2 wt percent and 10 wt percent were used. The reactions of CO dissociation (measured via the disportionation of CO) and C gasification were also studied. A mechanism is proposed in which CO and H2 compete for adsorption sites, the (CO + H2) reaction to form C and H2O is rate-determining, and the (C + Hs) reaction to form CH4 is fast. Dissert. Abstr.

N79-24093 Utah Univ., Salt Lake City.
STEAM REFORMING OF AROMATIC COMPOUNDS Ph.D. Thesis
Shri Krishan Krishan 1979 235 p
Avail: Univ. Microfilms Order No. 7910868

A computer program (FORTRAN) was made to calculate thermodynamic equilibrium product composition for steam reforming of benzene, toluene, naphthalene and anthracene over a range of temperature (400-900 C), pressures (0-1000 psig) and and steam ratios (1 to 10). The thermodynamic results, showed that steam reforming of aromatic compounds (and finally of coal derived liquids) can be carried out with slightly higher steam ratios compared with that for methane and napthitha.

The development of a highly active and very stable catalyst requiring a minimum steam ratio for steam reforming of aromatic compounds is presented. This catalyst had an Al203 surface area of 150 sq gm and a nickel specific surface area of 4.5 sq gm. The experimental runs for different aromatic compounds were carried out in a plug flow reactor of ss-316 with a 1 inch I.D. and 30 inches long. The product gas composition approached equilibrium at higher temperatures and the approach to equilibrium was less than 50 C. Dissert. Abstr.

N79-24094 Case Western Reserve Univ., Cleveland, Ohio.
FUNDAMENTALS OF ORDINARY ION EXCHANGE Ph.D. Thesis
Ajit Yeshwant Sane 1979 258 p
Avail: Univ. Microfilms Order No. 7909368

The ordinary ion exchange strengthening process takes advantage of the fact that glass failure is always the result of tensile stress. The strengthening of commercial soda-lime-silica glass was investigated using Na(+) exchange. A technique for photoelastic stress measurements is developed to study the residual stresses generated under different exchange conditions. The stress measurements on ion exchanged samples shows that stress relaxation is significant even at temperatures considerably below the strain point. A simple model is developed to account for stress relaxation during exchange. Flaw severity of an abraded glass, during the exchange, decreases rapidly due to environmental effects and later increases in proportion to the thickness of exchanged layer. A simple model is formulated to calculate the strength of an ion exchanged glass as a function of exchange temperature and time. Dissert. Abstr.

N79-24095 Oklahoma Univ., Norman.
ANALYSIS OF COKE COMBUSTION DURING IN-SITU OIL RECOVERY Ph.D. Thesis
Christian Olufemi Ozomaro 1978 154 p
Avail: Univ. Microfilms Order No. 7911160

A nonlinear optimization technique was developed for analyzing the data from coke combustion studies and the results indicate that the power law type rate expression does not adequately describe the coke combustion kinetics. Two combustion regimes were observed: an early period characterized by simultaneous carbon and hydrogen combustion and a later period characterized by pure carbon combustion. Analysis of atomic hydrogen carbon ratio further substantiate the above observation and conclusion. At temperature above 950 F, the coke combustion process was observed as being controlled by mass transfer while at temperatures below 900 F, the process is controlled by chemical kinetics. Regardless of the temperature regime under consideration, both mass transfer and reaction control mechanisms do exist. Parameters like coke concentration, combustion temperature, gas flow rate effect oxygen utility efficiency can explained in terms of the coke reaction kinetics. Dissert. Abstr.

N79-24096 British Library Lending Div., Boston Spa (England).
AUTOMATIC NUMERICAL CORRECTION FOR TECHNICON AUTOANALYSER OUTPUT
Jordi Font Apr. 1979 11 p refs Transl. into ENGLISH of rept. from Inst. de Investigaciones Pewqueras P. Nacl., Barcelona
(BLL-RTS-11785) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A redesigned model of the Autoanalyzer Technicon is presented. The system analyzes salt nutrients from sea water. A mathematical model allows for the calculation of the input signals from the output signals. M.M.M.

N79-24097*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF MEDIUM AND HIGH TEMPERATURE PHASE CHANGE MATERIALS
D. Heine and H. Kraehling Apr. 1979 48 p ref Transl. into ENGLISH of "Untersuchung von Mittel und Hochtemperaturlatent waermespeichermaterialen", Rept. IKE-5TF-296-79 Inst. fuer Kerntechnik und Energiewandlung e.V., Stuttgart, Jan. 1979 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75398; IKE-5TF-296-79) Avail: NTIS HC A03/MF A01 CSCL 07D

A detailed description of the programs for acquisition and analysis of the test results is given. Basically it concerns three programs. The TEST program controls the recording of the test data. With the THELLI program it is possible to follow the temperature curve recorded for each individual thermoelement during the test. With the AUSW program the test data can be analyzed, to determine, for example, the melting point and the start of melting. The first results of the service life tests are discussed. From these it is attempted to draw inferences for the subsequent tests. An attempt is made to focus on the determination of the area-related mass loss, the reduction in thickness and the corrosion rate as well as optical and scanning electron microscope evaluation. G.Y.

N79-24098# National Physical Research Lab., Pretoria (South Africa).
USING THE ION MICROPROBE MASS ANALYSER FOR TRACE ELEMENT ANALYSIS
J. H. Schilling 1978 18 p Presented at the Symp. on Trace Elem. Anal. Tech., Cape Town, Apr. 1978
(CSIR-FIS-174) Avail: NTIS HC A02/MF A01

A description of the instrument and the analytical techniques used, the secondary ion mass spectrometry, are discussed followed by a presentation of quantitative analyses and the related subjects of detection limit and sample construction. Examples of the use of the instrument are given. M.M.M.

N79-24099# Rice Univ., Houston, Tex.
RESEARCH IN FLUORINE CHEMISTRY Final Report, 1 Jun. 1971 - 31 Jul. 1978
John L. Margrave, R. H. Hauge, R. B. Badachhape, P. Kamarchik, K. R. Kunze, R. L. Pabst, P. L. Perry, P. Meier, S. Gransden, K. Y. San et al Jan. 1979 14 p refs
(Grants DA-ARO(D)-31-124-71-G125; DAHC04-74-G-0187; DAAG29-77-G-0187)
(AD-A065527; ARO-9965.16-C) Avail: NTIS HC A02/MF A01 CSCL 07/2

Studies in inorganic fluorine chemistry and high pressure chemistry have been published. The work was divided into the following areas. (1) Preparation and Properties of CFX, (2) Economical Preparation of CFX, (3) High Pressure Studies of CFX, (4) Reactions of Fluorine with Organic Compounds, (5) Fluorination of Nitrides, (6) Hydrolysis of Fluorides, (7) Reactions in Fluorine Matrices at Low Temperatures, (8) New Methods for Preparation of Elemental Fluorine without Electrolysis, and (9) The Chemistry of SiF2. Author (GRA)

N79-24100# Indiana Univ. at Bloomington. Dept. of Chemistry.
COMPARISON OF ATOMIC FLUORESCENCE POWER EFFICIENCIES FOR THE HELIUM-OXYGEN-ACETYLENE AND AIR-ACETYLENE FLAMES Interim Technical Report
K. A. Saturday and G. M. Hieftje 5 Mar. 1979 41 p refs
(Contract N00014-76-C-0838; Grant NSF CHE-77-22152; NR Proj. 051-622)
(AD-A066083; TR-23) Avail: NTIS HC A03/MF A01 CSCL 07/2

Power efficiencies for five elements have been measured for the helium-oxygen-acetylene and air-acetylene flames. The increased power efficiencies found in this study for the helium-diluted flame, coupled with its enhanced atom formation capabilities, suggest that greater atomic fluorescence sensitivity should exist. However, in a comparison study with an air-acetylene flame using identical experimental conditions, a decreased atomic fluorescence signal-to-noise ratio was found for most elements in the helium-diluted flame. This decrease has been ascribed to greater background emission noise in the higher-temperature helium-diluted flame and decreased nebulization efficiency caused by the low density of the helium-containing nebulizer gas. A comparison of flame emission detection limits for the two flames indicates the increased sensitivity of the higher-temperature helium-acetylene flame, despite its lower nebulization efficiency. Author (GRA)

N79-24101# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
PRELIMINARY INVESTIGATION OF THE NONSTEADY COMBUSTION AND FLOW PROCESSES OF THE NAVAL

ACADEMY HEAT BALANCED ENGINE (NAHBE) Progress Report, Jul. 1976 - Sep. 1977
Raghavan P. Pandalai (George Washington Univ., Washington, D. C.) and A. A. Pouring May 1978 61 p refs
(AD-A066085; USNA-EW-10-78) Avail: NTIS HC A04/MF A01 CSCL 21/2

This report describes the analytical work done on the Naval Academy Heat Balanced Engine (NAHBE) combustion process. The purpose of this one year study is to investigate the proposed utilization of pressure exchange mechanism and the basic nonsteady flow processes and combustion phenomena associated with the NAHBE combustion system, utilizing the experimental test data obtained over a period of years at the U.S. Naval Academy, Annapolis. A preliminary analysis of the effect of pressure exchange on the performance of the NAHBE engine is given in reference (5) based on the volume mode approach. A front mode approach is assumed to construct a wave diagram as a first step towards an understanding of the nonsteady flow dynamics of NAHBE combustion system. Further, two simple heat release models are used to obtain expressions for pressure and the results compared with experimental NAHBE test data.
Author (GRA)

N79-24102# School of Aerospace Medicine, Brooks AFB, Tex.
EXHAUST GAS COMPOSITION OF THE F-16 EMERGENCY POWER UNIT Interim Report, 1 Oct. 1977 - 31 Mar. 1978
Harry J. Suggs, Leonard J. Luskus, Herman J. Kilian, and Joseph W. Mokry Feb. 1979 18 p refs
(AD-A065595; SAM-TR-79-2) Avail: NTIS HC A02/MF A01 CSCL 21/2

A study was made of the exhaust gas from the monopropellant hydrazine-fueled emergency power unit (EPU) on the F-16 aircraft. An extractive sampling technique was used to sample for the known exhaust gas components, ammonia, hydrazine, and nitrogen, and to determine if unreacted hydrazine was present. The purpose of the study was to obtain data necessary to evaluate health hazards potential to workers who may be exposed to the exhaust, although an unlikely event. Emphasis was placed on the first minute of operation of the EPU following a cold-start under no-load conditions as the most likely personnel exposure conditions for either planned test firings or inadvertent firings. The amount of unreacted hydrazine was found to be as much as 24 grams per firing, with 65%-95% of this amount emitted in the first thirty seconds of operation. Recommendations for protection of personnel ammonia and hydrazine are presented.
Author (GRA)

N79-24103# Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
APPLICATION OF FOAM SEPARATION TO AQUEOUS SOLUTIONS OF TRINITROTOLUENE (TNT). PART 2: REMOVAL OF ORGANIC EXPLOSIVES WITH SURFACTANTS Final Report, 1 Jan. 1977 - 28 Feb. 1978
Yoshiyuki Okamoto, Eng J. Chou, Michael Croce, and Milton Roth Dec. 1978 60 p refs
(Contract DAAA21-76-C-0104)
(AD-A066118; AD-E400276; ARLCD-CR-78020-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 13/2

Process parameters have been developed which permit purification of wastewaters containing dissolved TNT, RDX, or nitroglycerin by treating the wastewater with a surfactant of the quaternary amine type at a pH of about 11.5. With TNT, the surfactant forms a precipitate that is removed by filtration. The other explosives, if present, are removed by hydrolysis. This reaction is accelerated by the surfactant. Nitroguanidine is unaffected by the surfactant treatment, but can be destroyed by contact with an ion exchange resin. The methods of analysis are described for RDX and TNT in pink water and for nitroglycerin and nitroguanidine in other wastewaters. The recommended process for pilot plant operation is also described. Author (GRA)

N79-24104# Little (Arthur D.), Inc., Cambridge, Mass.
FLAME ARRESTOR DESIGN REQUIREMENTS FOR PROLONGED EXPOSURE TO METHANE/AIR AND GASOLINE/AIR FLAMES Final Report
R. P. Wilson and D. P. Crowley 15 Sep. 1978 53 p refs
(Contract DOT-CG-42357-A)
(AD-A063002; USCG-D-73-78) Avail: NTIS HC A04/MF A01 CSCL 21/2

Tests were performed in order to extend the empirical basis for evaluating the design of flame arrestors to the case of prolonged exposure to a stabilized flame for periods up to 30 minutes. Both parallel plate arrestors and crimped ribbon arrestors, whose dimensions of passageway diameter and length had been shown to be marginal for arresting moving methane/air and butane/air flames were rested. The results of the tests demonstrated that the design criteria to withstand prolonged exposure to a stabilized flame were slightly more stringent than criteria for quenching or arresting a moving flame.
GRA

N79-24105# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
ON THE CORRELATION OF THE KINETICS OF ELECTRON TRANSFER PROCESSES WITH THE CHANGE IN REACTION FREE ENERGY. APPLICATION TO ELECTRON-EXCHANGE INITIATED CHEMILUMINESCENCE REACTIONS
Gary B. Schuster 20 Mar. 1979 17 p refs
(Contract N00014-76-C-0745)
(AD-A066342; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

The general electron transfer reaction mechanism proposed by Weller is analyzed for three specific cases: the electron transfer is exergonic and irreversible, the electron transfer is endergonic and reversible, and the electron transfer is endergonic and irreversible. In the last case it is revealed that the correlation of the log of the overall reaction rate constant with reaction free energy gives a line with a slope of -alpha/RT. The constant alpha is associated with the well-known transfer coefficient for electrode reactions. Analysis of the kinetics of chemically initiated electron-exchange luminescence (CIEEL) reactions reveals that they conform to the third case with alpha of ca. 0.3. Several other electron transfer reactions are suggested to be proceeding by this mechanism as well.
Author (GRA)

N79-24106# Tulsa Univ., Okla.
EXPERIMENTAL STUDY OF THE KINETICS OF DRY, FORWARD COMBUSTION Final Report
G. W. Thomas, A. P. Buthod, and O. Allag Feb. 1979 124 p refs
(Contract ET-77-S-03-1820)
(BETC-1820-1) Avail: NTIS HC A06/MF A01

Results are presented of an experimental investigation of dry, forward combustion with two main objectives: (1) to develop a method for determining the kinetic parameters of fuel laydown and burnoff from combustion tube data, and (2) to evaluate them for a particular crude-sand mixture. A two-step chain reaction model is postulated in which fuel laydown and burnoff are considered as competitive kinetic reactions. Laboratory equipment consists of a combustion tube assembly and sampling probe. A flow control system, an electronic control assembly, and a fluid analysis system are described in detail. Six experimental runs were performed using a 27 API Prudhoe Bay crude. Analyses of the data indicate that, in addition to the coke residue, some light ends of the crude enter into the total fuel consumed by the burning zone. A technique is presented for solving the integral equation and estimating the activation energies, pre-exponential factors, and some associated constants for fuel deposition and combustion.
DOE

N79-24107# Mound Lab., Miamisburg, Ohio.
PROPOSED IMPLEMENTATION OF LASER RAMAN SCATTERING SPECTROSCOPY FOR ANALYSIS OF HYDROGEN ISOTOPES
Stephen M. Craven and John T. Gill 14 Feb. 1979 25 p refs
(Contract EY-76-C-04-0053)
(MLM-2583) Avail: NTIS HC A02/MF A01

Of the techniques described and investigated, coherent antiStokes Raman scattering and laser Raman scattering (LRS) spectroscopics, the latter method proved to be more amenable to routine measurement of hydrogen isotopic species. An available LRS instrument, with some improvements, could attain estimated relative standard deviation reproducibilities of 0.1 to 0.3% for major hydrogen components, an order of magnitude improvements over previously reported laser Raman analytical observations. Gases present at less than 0.1% of a sample could be observable

with relative precisions as small as 2.4%. A system designed to obtain these results is proposed and discussed in detail. DOE

N79-24108# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
MICROSCOPIC STUDY OF THE GAS-SOLID INTERFACE DURING THE VAPOR PHASE OF EPITAXY Final Report [ETUDE MICROSCOPIQUE DE L'INTERFACE GAZ-SOLIDE EN COURS DE CROISSANCE EN PHASE VAPEUR]
J. B. Theeten and F. Hottier Dec. 1977 35 p refs In FRENCH
(Contract DGRST-76-7-0779)
(LEP-77/9.SME-618-B) Avail: NTIS HC A03/MF A01

A thorough microscopic analysis of the vapor phase (GaAs-H2-AsCl3) in a system for crystal growth was conducted. The apparatus used allows for analysis in situ and in real time of the growth interface by means of an automatic ellipsometer linked to a computer. An airlock chamber provides direct transfer of the sample from the reactor to a UHV jig equipped for surface characterization. The basic study carried out on the homoepitaxy of GaAs makes possible experimental verification, on a microscopic scale, of models suggested in consideration of thermodynamics. Detailed descriptions of heating to temperature, stripping, and of the beginning of growth of several types of surfaces are given. More in depth research on ternary composites (Ga(I-X)AlxAs and GaAs (I-x)Px) shows that it is possible to determine in situ by ellipsometry the composition of a layer as well as the growth rate. Author (ESA)

N79-24109# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Forsch. Inst. fuer Angew. Naturwiss. E. V.
THE THEORY OF SPECTRUM ANALYSIS OF STOCHASTIC PROCESSES
Wulf Brandenburg Jul. 1978 73 p refs In GERMAN; ENGLISH summary
(Rept-0-78) Avail: NTIS HC A04/MF A01

The mathematical basis of spectrum estimation of stochastic processes is presented. Two methods for the analysis are described. They are the autocorrelation function method using a discrete Fourier transform on the autorcorrelation function of a signal and the maximum entrophy method. These methods are compared theoretically and by the use of simulated data. Errors caused by incomplete knowledge of the autocorrelation function are not considered. Author (ESA)

N79-24110# Gulf South Research Inst., New Orleans, La.
NEW POLYMERIC MEMBRANES CONTAINING PHOSPHONATE ESTER GROUPS FOR WATER DESALINATION
Isreal C. Cabasso Jan. 1979 72 p refs
(Contracts DI-14-34-0001-7545; DI-14-34-0001-6523; OWRT Proj. 7545(1))
(PB-290609/7; W79-03688) Avail: NTIS HC A04/MF A01 CSCL 07D

Three novel polymer membranes for water desalination by reverse osmosis were originated and characterized. Two of these, alloy membranes, were composed of cellulose acetate/poly (bromophenylene oxide phosphonate) and cellulose acetate/poly (4-vinyl pyridine). The alloy membranes were cast as dense and asymmetric membranes. For the first alloy, CA/PPOBrP, two different structures were identified for the asymmetric membrane. The second alloy, CA/PVPy, has the same morphology as cellulose acetate when cast as an asymmetric membrane. The third membrane was an asymmetric PPOBrP membrane. This polymer was cast into an asymmetric membrane which displays a sharp boundary between the skin and the porous structure - resembling a composite membrane. GRA

N79-24111# Battelle Columbus Labs., Ohio.
IDENTIFICATION OF ORGANIC COMPOUNDS IN INDUSTRIAL EFFLUENT DISCHARGES
Donald L. Perry, C. C. Chuang, Gregory A. Jungclaus, and J. Scott Warner Nov. 1978 246 p refs
(Contract EPA-68-01-4350)
(PB-291900/9; EPA-560/6-78-009) Avail: NTIS HC A11/MF A01 CSCL 07D

Samples of 63 effluent and 22 intake waters were collected from a wide range of chemical manufacturers in areas across the United States. The samples were analyzed for organic compounds in an effort to identify previously unknown and potentially hazardous organic pollutants. Organic constituents were identified using the computerized Biemann mass spectral matching system together with some manual interpretation and quantified using GC-FID peak area determinations. Generally, industrial effluents contained few priority pollutants. Most of the components found in the effluents were sepcific for a particular industrial site. The data suggest that environmentally important compounds would be overlooked if frequency of occurence is the major criterion for determining environmentally significant compounds. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-24112 British Library Lending Div., Boston Spa (England).
CONDITIONS OF PRECIPITATION OF ALUMINUM HYDROXIDE AND HYDRATED SILICA ON THE SURFACE OF TITANIUM DIOXIDE
I. P. Sorokin, N. N. Stremilova, T. A. Ermolaeva, V. T. Milko, L. A. Gavrilova, and A. I. Kolomeets Mar. 1979 7 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (USSR), no. 6, 1976 p 19-21
(BLL-RTS-11737) Avail: British Library Lending Div., Boston Spa, Engl.

The development of optimum conditions for the uniform coating of titanium dioxide particles with a modifying layer by the carbonation of aluminate and aluminosilicate solutions is presented. The quality of the surface treatment of titanium dioxide is characterized indirectly by the photochemical activity of the pigment. Examination of the modified samples show that the modifying layer formed by carbonation covers the surface of the TiO2 more uniformly, shielding the pigment from the action of ultraviolet light. M.M.M.

N79-24113 British Library Lending Div., Boston Spa (England).
NICKEL COATINGS ACHIEVED WITHOUT THE USE OF ELECTRIC CURRENT
H. Speckhardt Feb. 1979 22 p refs Transl. into ENGLISH from Metalloberflache (West Germany), v. 31, no. 9, 1977 p 399-403
(BLL-RTS-11605) Avail: British Library Lending Div., Boston Spa, Engl.

Unlike the galvanic deposition process, in the case of nickel-plating without the use of external electric current, the ion of the coating metal is not reduced with the help of an external source of electric current, but rather by means of a reducing agent from which electrons pass to the adjacent and physically free-orbiting nickel ions thus crossing an electrically conducting surface. The very first step in the discharge of nickel ions takes place in a pure immersion process. Those metals which are electrochemically inferior to nickel, both in nickel-plating solution and also from the point of view of the conditions relating to nickelplating, corrode first, and, in so doing, exhibit the cathodic discharge of nickel ions. As soon as a nickel particle comes into contact with the surface of the other metal, corrosion stops in that place, and at the same time, any metallic nickel present starts to undergo the autocatalytic process of further depositing of nickel. The chemical deposition of nickel coatings on structural and high-grade steels, aluminum, platinum, silver, copper, and chrome-nickel-steel is discussed. A.R.H.

N79-24114 California Univ., Riverside.
LOCAL ELECTRONIC PROPERTIES OF DILUTE MAGNETIC ALLOYS Ph.D. Thesis
Suthat Yoksan 1978 113 p
Avail: Univ. Microfilms Order No. 7911765

Some local properties of dilute magnetic alloys are studied both in the normal and the superconducting states using the Yamada-Yosida theory of the Anderson model. The effects of elastic and inelastic scattering are taken into account explicitly. It is found that near the transition temperature, the spatial variation of the superconducting order parameter around a single

magnetic impurity at large distances has a characteristic 1/r dependence with an amplitude proportional to the depression of T sub c, whereas at short distances, the spatial dependence is of the form (a+bcos2k sub Fr)/sq r+c/r. A microscopic calculation is also presented for the host nuclear spin-lattice relaxation time in the presence of 3d transition metal impurities in a host at T <<T sub k, as a function of impurity-host distance r. Two important mechanisms are considered; the relaxation due to the localized spin fluctuations, and the kinematic change because of the resonant scattering of conduction electrons. Dissert. Abstr.

N79-24115 Texas A&M Univ., College Station.
PATHWAYS FOR INTRAMOLECULAR CARBONYL EXCHANGE IN SOME METAL CARBONYL COMPLEXES Ph.D. Thesis
Brian Ernest Hanson 1978 92 p
Avail: Univ. Microfilms Order No. 7909199

The intramolecular carbonyl exchange processes which occur in metal carbonyl complexes of the cyclic polyenes, azulene, guaiazulene, and 7-H-indene were examined by carbon-13 NMR spectroscopy. These polyenes form dinuclear complexes with M2(CO)4L (M = Fe, Ru; L = CO, PEt3) fragments in which the polyene bridges the two metal atoms. A unique pathway for internuclear carbonyl exchange was observed in (7-H-indene) Fe2(CO)4PEt3. This process involved the transfer of one carbonyl ligand from the M(CO)2PEt3 fragment to the M(CO)2 group with a concomitant rearrangement of the pi-electron density in 7-H-indene. Local scrambling may then take place on the newly formed M(CO)3 group leading to selective scrambling of only three CO groups. Dissert. Abstr.

N79-24116 Tennessee Univ., Knoxville.
NUCLEAR MAGNETIC STUDIES OF TRIETHYLBORANE WITH COBALT AND NICKEL COMPOUNDS Ph.D. Thesis
Freddie Lee Tungate 1978 117 p
Avail: Univ. Microfilms Order No. 7911720

Ligands on the metal centers were selected which contained potential Lewis basic sites after coordination to the metal center. The extent of a contact chemical shift of the methylene and methyl hydrogens of triethylborane was evaluated by the temperature dependence of the chemical shift of these hydrogens. New values for the chemical shift and coupling constant of the hydrogens of triethylborane, believed to be the most accurate to date, were determined with the aid of a computer. The existence of a diazin bridged Co-B species was reported here for the first time, and a similar compound was suggested where the metal was Ni. Ultraviolet-visible studies were conducted to determine the coordination number of Co(II) as the thiocyanate in 50/50 (V/V) DMSO/CCl4. Dissert. Abstr.

N79-24117 Cornell Univ., Ithaca, N. Y.
MORPHOLOGY AND MECHANISM OF HYDROGEN ATTACK IN IRON-CARBON ALLOYS Ph.D. Thesis
Menachem Natan 1979 141 p
Avail: Univ. Microfilms Order No. 7910762

An experimental investigation of the methane pressure which serves as the main driving force for bubble growth in hydrogen attack was carried out on 2 materials: Ferrovac E iron and SAE 1020 steel. Studies of the morphology of attack on grain boundaries were carried out using such SEM and TEM techniques as fractography, micrography, and replication. The average methane pressure PCH4 was calculated, using an appropriate equation of state, from two experimentally found quantities: the total volume of methane bubbles and voids yielded by a density measurement, and the total methane content obtained by a vacuum extraction method. The methane content depends on exposure conditions, carbon content, alloying elements and density loss. It is independent of specimen size and grain size. It increases with increasing PH2, decreasing T, increasing carbon content and density loss. Alloying elements that form carbides more stable than Fe3C decrease the methane content. Dissert. Abstr.

N79-24118 Cornell Univ., Ithaca, N. Y.
METALLIC XENON Ph.D. Thesis
David Albert Nelson, Jr. 1979 53 p
Avail: Univ. Microfilms Order No. 7910822

Diamond indentors with radii of 39 - 108 microns were used to pressurize thin films of solid xenon deposited on diamond flats. The resistance of the film versus pressure was measured using two complimentary methods. In the first, a nickel interdigitated grid with finger widths and spacings of 3 microns was deposited on the diamond flat using photolithographic techniques. The grid acted as the leads for two lead resistance measurements. In the second, the indentor and flat were both coated with nickel and acted as the leads themselves. Xenon was observed to transform from an insulating to a metallic state at a pressure of 33 + or - 3 GPa at temperatures between 30 K and 40 K. The resistivity of metallic xenon was shown to be at least 0.15 Omega cm, although it is probably much lower. Lead resistance was the limiting factor. Dissert. Abstr.

N79-24119 Connecticut Univ., Storrs.
THE FATIGUE OF Ti6Al4V ALLOY IN COARSE AND FINE STRUCTURAL CONDITIONS UNDER FULLY REVERSE LOADING AS WELL AS PULSATING TENSION Ph.D. Thesis
Roger King Steele 1978 227 p
Avail: Univ. Microfilms Order No. 7911410

An analytical and experimental investigation was made of the fatigue behavior of Ti6Al4V alloy in the life range from 10 to 2nd power to 10 to the 7th power cycles. The primary intent was to provide a better understanding of why the coarse structured alloy exhibits anomolously low long life fatigue strength when tested under tensile mean stress conditions. Three major structural conditions were incl rded: alpha/Beta coarsened forging, as received bar, and Beta quenched and annealed forging. Tests were made under fully reverse loading conditions as well as under tensile mean stress determining the cyclic plastic behavior at lives less than 100,000 cycles and S/N type behavior at longer lives. Monotonic tension and compression tests have been made along with room temperature microcreep tests. Surface replication and fractographic studies of the crack initiation event were included also. Dissert. Abstr.

N79-24120# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
RATE OF DESULFURIZATION FROM LIQUID IRON AND IRON ALLOYS WITH HYDROGEN
Mitsutako Hino, Shiro Ban-ya, and Tasuku Fuwa 1979 31 p refs Transl. into ENGLISH from Tetsu to Hagane (Japan), vol. 62, no. 1, 1976 p 33-42
(NRC/CNR-TT-1930; ISSN-0077-5606) Avail: NTIS HC A03/MF A01

The desulfurization of liquid iron mainly taking place between slag-metals was investigated to provide a basic study on gas-liquid reactions at high temperatures. The reaction rates were not determined by the conventional liquid iron sampling method, but by following the extent of reaction per unit time by continuously measuring the quantity of hydrogen sulfide produced during the reaction. The effects of the reaction gas's flow rate, the reaction temperature, stirring of the liquid iron, the partial pressure of the reaction gas, and alloying elements on the rate of desulfurization were determined. The alloying elements studied included carbon, silicon, and phosphorus, which increase the activity of sulfur in liquid iron, vanadium, which decreases the activity; and oxygen, which is the surface active element. Reaction mechanisms of these systems are discussed. Author

N79-24121*# AiResearch Mfg. Co., Phoenix, Ariz.
LOW-COST DIRECTIONALLY-SOLIDIFIED TURBINE BLADES, VOLUME 1 Completion Report
L. W. Sink, G. S. Hoppin, III, and M. Fujii Jan. 1979 272 p (Contract NAS3-20073)
(NASA-CR-159464; AiResearch-21-2953-1) Avail: NTIS HC A12/MF A01 CSCL 11F

A low cost process of manufacturing high stress rupture strength directionally-solidified high pressure turbine blades was successfully developed for the TFE731-3 Turbofan Engine. The basic processing parameters were established using MAR-M 247 and employing the exothermic directional-solidification process in trial castings of turbine blades. Nickel-based alloys were evaluated as directionally-solidified cast blades. A new turbine blade, disk, and associated components were then designed using previously determined material properties. Engine tests were run and the results were analyzed and compared to the originally established goals. The results showed that the stress rupture

strength of exothermically heated, directionally-solidified MAR-M 247 turbine blades exceeded program objectives and that the performance and cost reduction goals were achieved. R.E.S.

N79-24122# Aeronautical Research Labs., Melbourne (Australia).
SIMPLE ACOUSTIC EMISSION TESTS FOR THE DETECTION OF CORROSION
Ian G. Scott and Lance Wilson Jun. 1978 13 p
(AD-A065965; ARL-MAT-Note-122) Avail: NTIS HC A02/MF A01 CSCL 11/6

Simple acoustic emission equipment was used for laboratory tests on corrosive systems. Although the precise source of the acoustic emission is not yet known, these tests demonstrated the potential usefulness of the technique for the detection of active corrosion. Author (GRA)

N79-24123# Battelle Columbus Labs., Ohio.
EFFECTS OF HOT FORGING VARIABLES UPON MICROSTRUCTURE AND PROPERTIES OF METALS AND ALLOYS Final Technical Report, 1 Jan. 1976 - 31 Dec. 1978
T. Altan, A. H. Clauer, G. D. Lahoti, A. R. Rosenfield, and T. L. Subramanian 23 Feb. 1978 59 p refs
(Grant AF-AFOSR-2971-76)
(AD-A065674; AFOSR-79-0239TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

This research program focused on hot forging of nickel. Nickel-base alloys, their development, and fabrication are important to the Air Force in its efforts to increase the operating temperatures, decrease weight in aircraft, and to minimize waste during processing to the final products. Hot forging is an important step in the forming of engine discs, blades and vanes of superalloys or titanium alloys, and also in forming non-engine components such as aluminum or titanium alloy structural airframe parts. Accordingly, a basic understanding of the hot forging process is important for improving its efficiency and usefulness. This kind of research can best be accomplished through an approach incorporating a cooperative interaction between materials scientists engaged in high temperature deformation and fracture, and mechanicists experienced in analyzing metal flow during complex processing operations. This grant combined both approaches in an interactive manner to selected metals alloys. The goal was to further the fundamental understanding of the mechanisms of hot working including flow and fracture, to analyze in detail the hot forging process for several simple shapes, and to tie these areas together in an analysis of the relation between the hot forging parameters and the material response in terms of microstructure, cracking, working loads, and temperatures. GRA

N79-24124# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EFFECTS OF ISOTHERMAL FORGING CONDITIONS ON THE PROPERTIES AND MICROSTRUCTURES OF Ti-10V-2Fe-3Al Final Report, Mar. 1975 - May. 1978
Ivan Antonio Martorell Dec. 1978 197 p refs
(AF Proj. 2418)
(AD-A066062; AFML-TR-78-114) Avail: NTIS HC A09/MF A01 CSCL 11/6

The effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al were investigated. Ring specimens with two different grain sizes were forged isothermally on a hydraulic press at two different speeds (0.03 and 3.0 ipm). The ring specimens with the smaller grains (8 microns) were forged at three temperatures 1250 F(677 C), 1350 F(732 C) and 1450 F(788 C); the rings with the larger grains (255 microns) were forged at eight temperatures in the range 1190 F(643 C) to 1750 F(954 C). After forging, the rings were quenched in water to retain the as-forged structure. The resulting microstructures were determined. The room temperature mechanical properties resulting from forging at selected conditions were also determined. The flow stress and the resulting microstructures and mechanical properties depend on the forging conditions used, which can be characterized by the value of the flow stress. It is proposed that if the flow stress (forging conditions) is known, the room temperature mechanical properties (tensile, fracture toughness, W/A) may be closely estimated. Furthermore, a long-term relation is shown to exist between room temperature Rockwell C hardness and flow stress and room temperature properties, which could be used for a rough estimate of the properties of the as-forged material. GRA

N79-24125# California Univ., Los Angeles. Dept. of Materials.
MAGNETOMECHANICAL ACOUSTIC EMISSION OF IRON AND STEELS
Kanji Ono and M. Shibata Jan. 1979 29 p refs
(Contract N00014-75-C-0419)
(AD-A066082; TR-79-01) Avail: NTIS HC A03/MF A01 CSCL 11/6

The motion of magnetic domain walls in ferromagnetic materials produces acoustic emission (AE). This type of AE was detected during magnetization of a nickel and during elastic loading of iron. Recently, this was also found to depend on applied stress. Varying AE outputs were observed on several ferromagnetic materials under alternating magnetic field. This magnetomechanical AE phenomenon has a potential of performing nondestructive measurements of residual stresses in structures, components and weldments, and we examined systematically effects of applied stress and magnetic field strength in ferritic steels. This measurements of residual stresses in structures, components and weldments, and we examined systematically effects of applied stress and magnetic field strength in ferritic steels. Several carbon steels, A 533 B steel and commercially pure iron were tested in annealed or normalized condition. By employing two AE transducers of different resonant frequencies, rms voltages were measured at two frequency ranges. Maximum stress level was 350 MPa. It was found that 1020 steel shows the highest AE response among the materials tested. Residual stress levels can be determined by monitoring the ratio of the outputs of two AE transducers for a given material condition. The amount of prior cold work and the difference in heat treatment can also be determined by monitoring this AE phenomenon. Several exploratory experiments for developing a new method of nondestructive evaluation of residual stress and material conditions have also been conducted. Results of these experiments are described and discussed in detail. Author (GRA)

N79-24126# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
BARNACLE ELECTRODE MEASUREMENT SYSTEM FOR HYDROGEN IN AIRCRAFT STEEL Final Report, 22 Sep. 1977 - 21 Sep. 1978
Florian Mansfeld Nov. 1978 69 p refs
(Contract N62269-77-C-0351)
(AD-A065945; SC5128.2FR; NADC-77112-30) Avail: NTIS HC A04/MF A01 CSCL 11/6

A portable measurement system for determination of the hydrogen concentration in steels has been developed under contract with the Naval Air Development Center (NADC). This system which is based on the electrochemical permeation technique consists of the barnacle cell, so called because of its magnetic attachment to steel surfaces, and the electronic measurement system. Three prototypes of the combined system have been delivered to NADC. This report contains a description of the barnacle cell and the measurement system including all drawings for the cell components and for the electronic circuits. Complete descriptions of the operating procedures are included. Experimental results obtained with the combined system on 4130 steel and cadmium plated 4340 steel obtained from NADC are presented. Author (GRA)

N79-24127# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
RELATION OF STRUCTURE TO FATIGUE PROPERTIES IN ALUMINUM-BASE ALLOYS Final Report, 1 Oct. 1975 - 30 Sep. 1978
Morris E. Fine 30 Nov. 1978 30 p refs
(Grant AF-AFOSR-2892-76)
(AD-A062698; AFOSR-78-1518TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The roles of microstructure and plastic deformation in fatigue crack initiation and propagation in selected aluminum-base alloys were studied in an effort to improve the fatigue resistance of aluminum alloys. Results are reported. J.M.S.

N79-24128# IIT Research Inst., Chicago, Ill.
ESTABLISHMENT OF A PROCESS FOR CREEP FORGING ALUMINUM ALLOY WEAPON COMPONENTS Final Technical Report
N. C. Birla, K. M. Kulkarni, W. Berner, and S. Bhattacharyya Apr. 1978 143 p refs
(Contract DAAA09-75-C-2056)
(AD-A062491; IITRI-B6137-6) Avail: NTIS HC A07/MF A01 CSCL 11/6

Fabrication costs of aluminum weapon components were reduced by combining the ability of powder metallurgy processing to produce a well-proportioned preform and of creep forging to make a precision part. Elemental 7075 blended aluminum powder was characterized, requisite process criteria were established, and a preliminary process specification was formulated. Variables investigated under a statistical desianed experimental program were (1) particle size, (2) preform density, (3) sintering temperature, (4) forging temperature, and (5) percent forging deformation. Using the requisite process criteria set up from these variables, a preliminary process specification was formulated and further refined by isostatic pressing of trapezoidal performs and their forging into T shapes. The resultant forgings had elements of forward extrusion, backward extrusion, and lateral flow and helped define the optimized parameters necessary for creep forging. Effectiveness of the process was demonstrated by a prototype production of a cam component for the 105mm howitzer. GRA

N79-24129# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
CRYSTALLOGRAPHIC AND FRACTOGRAPHIC STUDIES OF HYDROGEN-INDUCED CRACKING IN PURIFIED IRON AND IRON-SILICON ALLOYS
F. Nakasato and I. M. Berstein 27 Feb. 1978 14 p refs
(Contract N00014-75-C-0265; NR Proj. 036-099)
(AD-A062423; CMU-036-099-8; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/6

Purified iron and iron-silicon alloys with silicon contents up to 3 pct were cracked by cathodically charging with hydrogen even without the application of an external stress. An experimental technique was developed which enabled the exposure of the fracture surface formed purely by hydrogen charging, and to contrast this with an adjacent mechanically induced fracture surface. In the case of purified iron, hydrogen induced cracks are-found to occur on potential slip planes whereas in the case of iron-3 pct silicon, the crack follows the observed cleavage plane. Intermediate silicon content alloys showed behavior. In agreement with the variation of crack plane in the alloys, the fracture surface appearances was also drastically different, reflecting the change in intrinsic toughness with alloy content. The observed transition from slip plane cracking to cleavage plane cracking was found to occur near a silicon content of 0.7 pct. The observed behavior is discussed in terms of how the intrinsic toughness of the iron-based lattice affects how hydrogen-induced cracks are formed. GRA

N79-24130# SRI International Corp., Menlo Park, Calif.
A STUDY TO DETERMINE THE MECHANISMS OF CORROSION OF COPPER-NICKEL ALLOYS IN SULFIDE-POLLUTED SEAWATER Annual Report, 2 Feb. 1978 - 1 Feb. 1979
Barry C. Syrett, Sharon S. Wing, and Digby D. MacDonald 1 Feb. 1979 132 p refs
(Contract N00014-77-C-0046)
(AD-A066257) Avail: NTIS HC A07/MF A01 CSCL 11/6

The main objective of this research was to determine the role of dissolved sulfide pollutants on the seawater corrosion of two copper nickel alloys--90:10 Cu:Ni (CA 706) and 70:30 Cu:Ni (CA 715). Electrochemical techniques were used to monitor corrosion rates in rotating cylinder experiments and in flow loop experiments. The effects of flow (velocity) and the composition of the seawater environment were considered. The highlights of this work are as follows: (1) Electrochemical methods are suitable for monitoring the corrosion rate of copper-nickel alloys in seawater if certain precautions are taken. (2) The presence of sulfide or one of several sulfide oxidation products turns noncorrosive deaerated seawater into a comparatively corrosive environment. (3) Sulfide-polluted deaerated seawater is less corrosive than unpolluted aerated seawater at Reynolds numbers up to 74,000 (velocities up to 5 m/s). (4) When the velocity of aerated seawater is increased from 2 m/s to 3 m/s (Reynolds number from 30,000 to 44,000), 70:30 Cu:Ni undergoes a transition from fairly uniform mild corrosion to accelerated localized corrosion. This breakaway corrosion phenomenon is interpreted in terms of a 'breakaway potential'. Author (GRA)

N79-24131# Bendix Corp., Kansas City, Mo.
PREDICTING STRESS CORROSION CRACKING IN WELDED STEEL BASED ON RESIDUAL STRESS MEASUREMENTS
D. H. Brewer Feb. 1979 53 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2099-Rev) Avail: NTIS HC A04/MF A01

Residual stress measurements were made on a welded HP-9-4-20 steel test coupon to determine the potential of residual stress for producing stress corrosion cracking. X-ray diffraction and strain gauge rosettes were used to make the measurements. Under the conditions specified, the stress intensity produced by residual stress was one-fourth that required to produce stress corrosion cracking. DOE

N79-24132# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
CORROSION STRESS CORROSION CRACKING, AND ELECTROCHEMISTRY OF THE IRON AND NICKEL BASE ALLOYS IN CAUSTIC ENVIRONMENTS Progress Report, 1 Mar. 1978 - 28 Feb. 1979
R. W. Staehle and A. K. Agrawal 1979 59 p refs
(Contract EY-76-S-02-2421)
(COO-2421-5) Avail: NTIS HC A04/MF A01

Brittle fracture was observed over the entire pH range but only at cathodic potentials which were below the hydrogen evolution region. Crack propagation rates (CPRs) in Nickel-200 were measured as a function of potential in 17.5N NaOH solution at 138 C, using the fast straining electrode technique. CPRs in the potential range -0.75 to -0.6V/sub/H were found high on the order of 10 to the minus 8th power m/s, but relatively low, outside this potential range. Crack propagation rates of Type 304L at 138 C in 17.5N NaOH solution with and without a chromate inhibitor were measured as a function of potential using the fast straining electrode technique. No significant drop in the CPR was observed due to the presence of the inhibitor in the solution. Corrosion rates of pure metals Fe, Cr, and Ni were estimated as a function of potential in the 17.5N NaOH solution at 130 C using the long-time current decay measurements. DOE

N79-24133# Hanford Engineering Development Lab., Richland, Wash.
EFFECTS OF IRRADIATION AND THERMAL AGING UPON FATIGUE-CRACK GROWTH BEHAVIOR OF REACTOR PRESSURE BOUNDARY MATERIALS
Lee A. James Oct. 1978 35 p refs Presented at IAEA Technical Comm. Meetings, Innsbruck, Austria, 20 Nov. 1978
(Contract EY-76-C-14-2170)
(HEDL-SA-1663; Conf-781177-1) Avail: NTIS HC A03/MF A01

Two processes that have the potential to produce degradation in the properties of pressure boundary materials are neutron irradiation and long-time thermal aging. Linear-elastic fracture mechanics techniques are used to assess the effect of these two processes upon the fatigue-crack growth behavior of a number of alloys commonly employed in reactor pressure boundaries. The materials evaluated include ferritic steels, austenitic stainless steels, and nickel-base alloys typical of those employed in a number of reactor types including water-cooled, gas-cooled, and liquid-metal-cooled designs. DOE

N79-24134# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Dept. Angewandte Mechanik und Stroemungsphysik.
SCATTERING OF Li IONS ON NICKEL SINGLE CRYSTAL PLANES IN THE 10-50eV ENERGY RANGE: EXPERIMENT AND COMPUTER SIMULATION Ph.D. Thesis - Goettingen Univ., West Ger.
Ursula Gerlach-Meyer Oct. 1977 154 p refs In GERMAN Prepared jointly with Goettingen Univ., West Ger.
(MPIS-16/1977) Avail: NTIS HC A08/MF A01; Max-Planck

Inst. fuer Stroemungsforsch., Goettingen, West Ger., DM 25.50

The experimental apparatus used for measurements with incident angles of between 10 and 70 deg and reflected angles of between 20 and 80 deg is described together with the preparation and control of the crystal. A potential model taking into account both repulsive and attractive forces was developed. Two types of scattering occur involving one or two surface atoms. A Delye model is used to describe the thermal motion of the surface atoms. Agreement between experiment and theory is very good for energy distributions but only qualitatively correct for angular distributions. Author (ESA)

N79-24135# National Technical Information Service, Springfield, Va.

HYDROGEN EMBRITTLEMENT OF METALS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Jan. 1979

William E. Reed Mar. 1979 217 p Supersedes NTIS/PS-78/0096; NTIS/PS-77/0004; NTIS/PS-75/749

(NTIS/PS-79/0177/0; NTIS/PS-78/0096; NTIS/PS-77/0004; NTIS/PS-75/749; NTIS/PS-75/049) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Studies on hydrogen embrittlement relating to mechanical properties, irradiation, crystal structure, and corrosion are cited. This compilation also covers testing, hydrogen analysis and diffusion, welding, electroplating, fabrication, and processing with respect to the ductile brittle transition in metals. Reports on nuclear reactor materials, hydrogen storage equipment, and energy related systems are included. This updated bibliography contains 208 abstracts, 42 of which are new entries to the previous edition. GRA

N79-24136# National Technical Information Service, Springfield, Va.

HYDROGEN EMBRITTLEMENT OF METALS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - 1977

William E. Reed Mar. 1979 212 p

(NTIS/PS-79/0178/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This bibliography cites reports from worldwide literature on hydrogen embrittlement and its effects on the microstructure, mechanical properties, and heat treatment of both ferrous and nonferrous metals used in pressure vessels, pipes, welds, engineering equipment, and electroplate. None of the 206 abstracts is new to the previous edition. GRA

N79-24137# National Technical Information Service, Springfield, Va.

HYDROGEN EMBRITTLEMENT OF METALS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978

William E. Reed Mar. 1979 141 p Supersedes NTIS/PS-78/0097; NTIS/PS-77/0006

(NTIS/PS-79/0179/6; NTIS/PS-78/0097; NTIS/PS-77/0006) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Research from worldwide journal literature on hydrogen embrittlement of ferrous and nonferrous metals is cited in this bibliography. Studies on mechanical properties, heat treatment, crystal structure, fracture, hydrogen diffusion, grain growth, strain, pressure, and testing in relation to embrittlement are covered. This phenomena is described in pressure vessels, pipes, welds, engineering equipment, and electroplates. This updated bibliography contains 134 abstracts, all of which are new entries to the previous edition. GRA

N79-24138# National Technical Information Service, Springfield, Va.

HYDROGEN EMBRITTLEMENT OF METALS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1971 - 1978

William E. Reed Mar. 1979 186 p

(NTIS/PS-79/0180/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Research reports on hydrogen embrittlement of ferrous and nonferrous metals are cited. Studies relating to mechanical properties, corrosion, failure, testing, and inhibition are presented. Hydrogen embrittlement is described in pressure vessels, pipes, welds, and steels. Reports on materials used in pipeline, refinery, petrochemical, and energy storage service are included. This bibliography contains 181 abstracts. GRA

N79-24139# National Technical Information Service, Springfield, Va.

SUPERALLOYS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1979

William E. Reed Mar. 1979 126 p Supersedes NTIS/PS-78/0199; NTIS/PS-77/0160; NTIS/PS-76/0109; NTIS/PS-75/179

(NTIS/PS-79/0220/8; NTIS/PS-78/0199; NTIS/PS-77/0160; NTIS/PS-76/0109; NTIS/PS-75/179) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally-funded research on cobalt- and nickel-based superalloys is cited. Casting and powder metallurgy of these alloys are covered. Properties such as heat resistance, corrosion resistance, microstructure, fracture, and creep are described. The use of these materials in nuclear reactors, gas turbine parts, and high temperature equipment is a major part of this compilation. This updated bibliography contains 120 abstracts, 33 of which are new entries to the previous edition. GRA

N79-24140# National Technical Information Service, Springfield, Va.

SUPERALLOYS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Feb. 1979

William E. Reed Mar. 1979 277 p Supersedes NTIS/PS-78/0201; NTIS/PS-77/0161; NTIS/PS-76/0108

(NTIS/PS-79/0221/6; NTIS/PS-78/0201; NTIS/PS-77/0161; NTIS/PS-76/0108) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Worldwide research is cited on cobalt-, iron-, and nickel-based superalloys. The manufacture, melting, casting, powder metallurgy, forging, and welding of these alloys are covered. Studies on corrosion, high and low temperature properties, physical, and mechanical properties of these materials are included. Applications discussed include nuclear reactors, gas turbines, superconducting machinery, and heat exchangers. This updated bibliography contains 271 abstracts, 100 of which are new entries to the previous edition. GRA

N79-24141# Maryland Univ., College Park. Dept. of Mechanical Engineering

PHOTOELASTIC STUDIES OF CRACK PROPAGATION AND ARREST IN POLYMERS AND 4340 STEEL Annual Report, 15 Jul. 1977 - 30 Sep. 1978

G. R. Irwin, T. Kobayashi, W. L. Fourney, J. T. Metcalf, and J. W. Dally Dec. 1978 330 p refs

(Contract NRC-04-76-12)

(PB-291508/0; NUREG-CR-0542) Avail: NTIS HC A15/MF A01 CSCL 11F

The progress made during the fourth year on a research program dealing with the dynamic characterization of fracture is reported. GRA

N79-24142# Battelle Columbus Labs., Ohio.

EVALUATING STRENGTH AND DUCTILITY OF IRRADIATED ZIRCALOY, TASK 5 Quarterly Progress Report, Apr. - Jun. 1978

L. M. Lowry, J. S. Perrin, A. J. Markworth, and W. J. Gallagher Nov. 1978 32 p refs Sponsored by Nucl. Regulatory Comm., Washington, D. C.

(PB-291511/4; BMI-2007; NUREG-CR-0582) Avail: NTIS HC A03/MF A01 CSCL 11F

A mechanical-property data base that can be used to predict the performance of Zircaloy cladding under various postulated off-normal, transient, and accident conditions in a power reactor was developed. Additional Lot 1 rods, H-7 and K-10, were characterized by visual examination, profilometry, eddy current testing, gamma scanning, and fission gas recovery. Also, additional Lot 2 rods, 47101 and 47125, were characterized by visual examination, profilometry, gamma scanning, and metallographic examination. The model used to analyze the uniform elongation data from tensile tests of specimens isothermally annealed cannot be expressed in linear form. A nonlinear technique used for the

isothermal data and is extended to include anisothermal data. GRA

N79-24143# National Technical Information Service, Springfield, Va.
CORROSION OF STAINESS STEEL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Mar. 1979
William E. Reed Mar. 1979 135 p Supersedes NTIS/PS-78/0233; NTIS/PS-77/0183; NTIS/PS-76/014 (NTIS/PS-79/0208/3; NTIS/PS-78/0233; NTIS/PS-77/0183; NTIS/PS-76/0114) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Research on stainless steel composition, mechanical properties, structure, and testing in relation to corrosion is cited. Nuclear reactor materials are studied as well as corrosion in coal gasification plants, rocket propellant tanks, underwater cables, batteries, and geothermal systems. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-24144 British Library Lending Div., Boston Spa (England).
RAPID METHOD FOR DETERMINING FREE FORMALDEHYDE IN PHENOL-FORMALDEHYDE RESINS
T. A. Ermolaeva Mar. 1979 6 p refs Transl. into ENGLISH from Metody Anal. Kontrolya Proizvod Khim. Prom-Sti. (USSR), no. 6, 1977 p 26-28
(BLL-RTS-11594) Avail: British Library Lending Div., Boston Spa, Engl.

A simple method was devised for determining free formaldehyde in phenol-formaldehyde resins based on extraction of formaldehyde with water with addition of acetone, filtration for separating the resin and subsequent colorimetric determination of the red complex of formaldehyde with phenylhydrazine. G.Y.

N79-24145 Tennessee Univ., Knoxville.
THE HIGH TEMPERATURE AQUEOUS MODIFICATION OF POLYBUTADIENE AND A STYRENE CROSSLINKED UNSATURATED POLYESTER Ph.D. Thesis
Ronald Reed Campbell 1978 175 p
Avail: Univ. Microfilms Order No. 7911666

Polybutadiene and a styrene crosslinked unsaturated polyester were subjected to neutral hydrolytic conditions. The study was carried out in order to determine if neutral hydrolysis is a feasible process for the reclamation of these polymers. Dissert. Abstr.

N79-24146 Akron Univ., Ohio.
NMR STUDIES OF SYNTHETIC POLYPEPTIDE STRUCTURES Ph.D. Thesis
Dimitrios Giannakidis 1979 237 p
Avail: Univ. Microfilms Order No. 7910871

Nuclear magnetic resonance and ultraviolet spectra of polyvalines and polyeucines prepared from N-carboxy anhydride (NCA) polymerizations initiated by sodium N-benzyl carbamate were recorded. These spectra contained resonances that are due to benzylamine fragments. Carbamate ions are able to add to NCA's during NCA polymerizations. Proton magnetic resonance studies on the alpha-CH patterns of poly-D,L-leucines having different monomer composition and molecular weights and being prepared with different initiators using different polymerization solvents, indicate that conformational information is discernible from their spectra. Alpha CH proton resonance patterns of polyleucines in conjunction with methoxy proton resonance patterns of sodium methoxide initiated polymers, indicate that the stereoselectivity previously claimed for alpha phenylethylamine initiated polymerizations is overestimated. Dissert. Abstr.

N79-24147 Connecticut Univ., Storrs.
BIODEGRADABLE POLYMER: SYNTHESIS AND CHARACTERIZATION OF METHYL- AND HYDROXYL-CONTAINING POLYAMIDES, POLYFUMARAMIDES, AND POLYENAMINES Ph.D. Thesis
Joseph Anthony Pavlisko, III 1978 210 p
Avail: Univ. Microfilms Order No. 7911400

Polyamides containing hydroxyl and methyl substituents were synthesized. Biodegradation of these polymers were investigated using concentrated proteolytic enzymes and microbial spore suspensions. The extent of biodegradation was evaluated spectrophotometrically and employing scanning electron micrography. Enzyme degradation results varied with substituent group concentration and did not necessarily reflect enzyme specificity. Microbial degradation results indicated a correlation between polymer morphology and extent of growth. Polyfumaramides were synthesized and their biodegradation investigated. Copoly (hexamethylenesebacic-co-fumaramides) were shown to be the more susceptible substrate of the polyfumaramides. Two new classes of polyenamines were synthesized. Dissert. Abstr.

N79-24148 Texas Univ. at Austin.
EFFECT OF ANNEALING BELOW THE GLASS TRANSITION TEMPERATURE ON SORPTION AND TRANSPORT OF CARBON DIOXIDE IN POLYCARBONATE Ph.D. Thesis
Andrew Heung Choi Chan 1978 156 p
Avail: Univ. Microfilms Order No. 7910942

The effect of sub T G annealing to decrease the amount of gas sorbed and which results in a reduction of the Langmuir capacity term is described. Correlation of this term with the apparent endotherm obtained from independent differential thermal anlaysis is suggestive of a parallel relaxation process. Density measurements provide gross evidence of the free volume interpretation of C sub H. The experimental uncertainties in the data compromise a more critical test of the relationship between C sub H and the density of the annealed samples. Mechanical properties from stress-strain tests indicate changes consistent with the free volume changes associated with sub T G annealing and CO2 exposure. Dissert. Abstr.

N79-24149 Princeton Univ., N. J.
POLYMERIZATION OF SICICA IN AQUEOUS SOLUTIONS Ph.D. Thesis
Lawrence Bruce Peck 1979 110 p
Avail: Univ. Microfilms Order No. 7910112

An analysis that divides the overall reaction into the successive stages of nucleation and growth of spherical polymer particles is reported. The growth stage is further classified into reaction- and diffusion-controlled regimes. The mathematical analysis of particle growth results in a dimensionless parameter which serves as an index of whether diffusion or chemical reaction exerts the dominant influence over the growth process. The analysis of diffusion-limited growth shows that the particle radii should increase as the square root of time early in the course of the reaction, and that the fractional conversion of monomer to polymer should increase as t to the 3/2 power. Progress toward an instrument capable of measuring the size distribution of silica particles, and thus of providing information on their number density is recorded. Dissert. Abstr.

N79-24150 Texas Univ. at Austin.
A STUDY OF MISCIBILITY IN BLENDS OF POLYCARBONATE WITH POLYESTERS Ph.D. Thesis
Carlos Alfonso CruzRamos 1978 293 p
Avail: Univ. Microfilms Order No. 7910945

A single amorphous phase is formed in blends of polycarbonate (PC) with certain polyesters. All of these polyesters are semicrystalline, and their respective degrees of crystallinity are affected by the presence of PC in the amorphous phase. Some of the polymers induce the formation of a small amount of crystallinity in PC. The identification of the specific interactions that are probably causing the extensive miscibility observed in PC-polyester systems was carried out by calorimetric determinations of the heats of mixing of low molecular weight analogs. Several esters were chosen as analogs for the different polyesters, and diphenyl carbonate, DPC, was selected as the model compound for PC. It was concluded that there is a specific interaction between the ester groups in the polyesters and the aromatic rings in the polycarbonate as well as good correlation with the state of miscility of the PC-polyester systems.
Dissert. Abstr.

N79-24151 Akron Univ., Ohio.
MECHANISMS OF RUBBER ABRASION Ph.D. Thesis
Carl Trevor Pulford 1979 170 p
Avail: Univ. Microfilms Order No. 7910872

An experimental study of the abrasion of several representative elastomers is described. Both strain crystallizing and amorphous compounds were worn under various conditions in a simple razor blade device, and samples of the resulting debris and surface were collected and observed directly by scanning electron microscopy. Under severe conditions abrasion is dominated by physical rupture on a scale of a few microns, thought to involve mechanical fatigue. A secondary process of particle removal occurs on a larger scale and increases with increasing severity of wear. In milder circumstances, mechanically initiated chemical effects are important. Observation of the sharpness of metal blades used as abraders has indicated that the chemical changes in the elastomer during abrasion can cause rapid metal wear. The process of tearing in rubber was examined by scanning electron microscopy. Dissert. Abstr.

N79-24152 Case Western Reserve Univ., Cleveland, Ohio.
A PROTON ACTIVATION STUDY OF OXYGEN DIFFUSION IN MULTICOMPONENT GLASS-FORMING SYSTEMS Ph.D. Thesis
Hanan Yinnon 1979 182 p
Avail: Univ. Microfilms Order No. 7909376

Oxygen self-diffusion was studied in a commercial soda-lime-silica and 20K2O-20SrO-60SiO2 (wt %) both in the glassy state and in the melt. A proton activation analysis technique was used to determine the concentration distribution of the stable isotope O-18 within the material following a gas/solid exchange. A diffusion coefficient and a surface exchange reaction coefficient were determined from the concentration distribution. The oxygen self-diffusion coefficient for the commercial soda-lime-silica composition between 290 and 620 C is given. At the temperature range 620 - 700 C for the soda lime-silica composition and 580 - 680 C for the potassium-strontium-silicate composition, the oxygen self-diffusion coefficient increases sharply by two orders of magnitude. The correlation between oxygen diffusivity and viscosity in the melt suggests that oxygen migration involves breaking bonds between bridging oxygens and silicons. Dissert. Abstr.

N79-24153*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEW PERFLUOROALKYL POLYTRIAZINES CONTAINING PENDENT IODODIFLUOROMETHYL GROUPS Patent Application
Robert W. Rosser and Theodore Psarras, inventors (to NASA) (PCR, Inc., Gainesville, Fla.) Filed 8 May 1979 11 p
(NASA-Case-ARC-11241-1; US-Patent-Appl-SN-037066) Avail: NTIS HC A02/MF A01 CSCL 07C

The synthesis of a sealer for aircraft structures is described. Perfluoroalkyl polytriazines containing pendent iodo difluoro methyl groups are prepared by the reaction of perfluoro alkyl dinitriles with ammonia to form poly(imidoylamidines), followed by the cyclization of the imidoylamidine groups with, e.g. various mixtures of a perfluoroacyl fluoride with an omega-iodo perfluoro acyl fluoride. The polytriazines obtained are cured by heat which causes crosslinking at the iodo difluoro methyl groups by elimination of iodine and formation of carbon to carbon bonds. NASA

N79-24154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM SPUTTER DEPOSITION OF FLUOROPOLYMERS Patent Application
Bruce A. Banks and James S. Sovey, inventors (to NASA) Filed 21 May 1979 8 p
(NASA-Case-LEW-13122-1; US-Patent-Appl-SN-041146) Avail: NTIS HC A02/MF A01 CSCL 07C

Ions are impinged on a fluoropolymer target which is the sputter deposition source for a large area substrate to be coated. A clear hydrophobic coating is produced on a substrate of selected solid materials. NASA

N79-24155# Vought Helicopter, Inc., Dallas, Tex.
STRUCTURAL PROPERTIES OF ADHESIVES, VOLUME 1 Final Technical Report, Apr. 1976 - Sep. 1978
W. J. Renton Sep. 1978 195 p refs 2 Vol.
(Contract F33615-76-C-5205)
(AD-A065500; Rept-2-53500/8CRL-96; AFML-TR-78-127-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 11/1

A ranked list of adhesive property data required to predict the response of the adhesive in a bonded joint under a variety of load and environmental conditions experienced by aircraft structures is presented. The assessed merits and deficiencies of existing test procedures to provide the adhesive property data are given along with a set of standard recommended test procedures for providing reliable, low cost data. The utility, ease of performance, and low cost of these various test methods for adhesives representing brittle and ductile structural behavior is demonstrated. J.M.S.

N79-24156# Vought Helicopter, Inc., Dallas, Tex.
STRUCTURAL PROPERTIES OF ADHESIVES. VOLUME 2: APPENDICES. A: THE SYMMETRIC LAP SHEAR TEST. B: ADHESIVE JOINT FABRICATION AND TEST SPECIFICATIONS Final Technical Report, Apr. 1976 - Sep. 1978
W. J. Renton Sep. 1978 124 p refs
(Contract F33615-76-C-5205)
(AD-A065521; ATC-2-53500/8CRL-96-Vol-2-App; AFML-TR-78-127-Vol-2-App-A-B) Avail: NTIS HC A06/MF A01 CSCL 11/1

To enable primary structures to be adhesively bonded in future aerospace hardware structural response prediction procedures must be improved upon. One task in accomplishing this overall objective is a req rirement that a set of standardized adhesive test specifications be formulated. It was the objective of this 'Structural Properties of Adhesives' program to develop low cost adhesive test procedures required to generate the required rigorous engineering structural property data. The desired engineering structural properties were specified as was their accuracy requirements. Optimum adhesive test specimens were designed as was a new adhesive deformation measurement system, a parallel plate capacitor. An extensive review of the literature on adhesive testing enabled the formulation of ASTM type adhesive test specifications for static, viscoelastic, and fatigue characterization of adhesives. A fabrication specification was also formulated. Selected test data were generated to verify that the test procedures were easy to perform and repeatable. Additional improvements in the butt joint test procedure were recommended. Author (GRA)

N79-24157# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CONFERENCE ON AEROSPACE POLYMERIC VISCOELASTIC DAMPING TECHNOLOGY FOR 1980'S
Lynn Rogers, ed. Jul. 1978 535 p refs Conf. held Dayton, Ohio, 7-8 Feb. 1978
(AD-A065518; AFFDL-TM-78-78-FBA) Avail: NTIS HC A23/MF A01 CSCL 11/9

The purpose of this report is to make available the technical papers presented at the Conference on Aerospace Polymeric Viscoelastic Damping Technology for the 1980's. The papers contained herein have been reproduced directly from the original manuscripts. Author (GRA)

N79-24158# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.
WATER ABSORPTION OF FLUIDS/OILS Final Report
Robert G. Jamison Jun. 1978 32 p
(AD-A065915; MERADCOM-2250) Avail: NTIS HC A03/MF A01 CSCL 11/8

The object of the investigation was to determine the effects of water absorption on the inhibitor systems and basestocks of various hydraulic fluids and engine oils. From this experimentation, a need was generated to develop a more accurate method for analyzing water in these fluids and oils. The results subsequently obtained verified the fact that absorbed water affects the stability of the inhibited fluid and oil systems. Author (GRA)

N79-24159# SRI International Corp., Menlo Park, Calif.
PRODUCTION OF CRACKS IN ZnS UNDER A UNIFORM DYNAMIC STRESS FIELD Annual Report
D. A. Shockey, Y. M. Gupta, and K. C. Dao Jan. 1979

23 p refs
(Contract N00014-76-C-0657; SRI Proj. PYU-4928)
(AD-A065941) Avail: NTIS HC A02/MF A01 CSCL 11/2

Plate impact and exploding cylinder experiments were performed on CVD ZnS and PMMA, respectively, to establish the applicability of the methods for studying dynamic fracture of brittle materials. Prerequisites for successful plate impact experiments are precise velocity control in the tens-of-meters per second range and specimen encapsulation. Prerequisites for successful exploding cylinder experiments are large specimens (to contain cracks), external compressive hoop stresses, and control over the type and amount of explosive. With these prerequisities, both methods appear to be useful for studying fracture response in fragile materials. Author (GRA)

N79-24160# Materials Research Labs., Ascot Vale (Australia).
ELECTRODEPOSITION PAINTING OF METAL SUBSTRATES: PINHOLING IN SURFACE FILMS
John A. Gagliardi and Daniel J. Whelan Aug. 1978 17 p refs
(AD-A065968; MRL-TN-415) Avail: NTIS HC A02/MF A01 CSCL 11/3

In the electrodeposition painting of mild steel panels defects are induced at higher electrodeposition voltages. Of these defects, pinholing appears to be the most serious and it occurs even after the surface has been coated at lower voltages with a thin, uniform coating. It probably originates from the conversion of electrical energy into heat energy which causes local boiling of occluded solvent in the film deposited on the work piece. Author (GRA)

N79-24161# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EVALUATION OF NEW BONDING SYSTEMS FOR DEPOT-LEVEL MAINTENANCE OF AIRCRAFT HONEYCOMB PANELS Final Report
Raymond F. Wegman, Marie C. Ross, William Russell, and Elizabeth A. Garnis Dec. 1978 55 p refs
(AD-A066117; AD-E400280; ARLCD-TR-78019) Avail: NTIS HC A04/MF A01 CSCL 11/1

Four adhesive systems, EA 9628, ADX 656.2, PL 717B, and M1113, are evaluated and reported to be improvements over adhesives presently used for bonding honeycomb structures in army helicopters. These systems have increased durability and fatigue properties but do not change the stiffness of the panel. Using corrosion-inhibiting primers can increase the life expectancy of the structure provided the application of the primer is very stringently controlled. An investigation into fracture analysis of failed joints indicates that the origin of failure, the mechanism of crack propagation, and an estimate of the load the joint experienced at the time of failure can be detected by a careful analysis of the joint. A nondestructive technique by which the degradation in a bonded panel can be followed using the Harmonic Bond Tester has been evaluated. The technique detects changes in the adhesive, the onset of corrosion in the bond line, and the presence of voids. Author (GRA)

N79-24162# Materials Research Labs., Ascot Vale (Australia).
THE COMBUSTION OF ORGANIC POLYMERIC MATERIALS. IGNITION PROPERTIES
James R. Brown and Evan P. Gellert Aug. 1978 16 p refs
(AD-A065967; MRL-TN-414) Avail: NTIS HC A02/MF A01 CSCL 11/9

The ignition properties of a number of organic materials of interest to Navy, including panelling materials, adhesives, unfilled polymers, and flexible cellular polymers, have been determined in a hot-air furnace. The method provides a measure of piloted and nonpiloted ignition temperatures of polymeric materials under controlled laboratory conditions. Values obtained represent the lowest ambient air temperatures that cause ignition under the conditions of the test and can be of considerable value in assessing and comparing the burning behaviour of materials. Author (GRA)

N79-24163# McDonnell Aircraft Co., St. Louis, Mo.
DEFINITION AND NON-DESTRUCTIVE DETECTION OF CRITICAL ADHESIVE BOND-LINE FLAWS Final Report, 27 Jun. 1975 - 31 Jul. 1978
H. T. Clark Wright-Patterson AFB, Ohio AFML Jul. 1978 93 p refs
(Contract F33615-75-C-5209; AF Proj. 486U)
(AD-A065584; AFML-TR-78-108) Avail: NTIS HC A05/MF A01 CSCL 11/6

Fatigue tests were conducted on adhesive bonded aluminum specimens with intentionally induced adhesive bondline flaws. Specimen design details, materials, type of surface preparation. The test loadings were selected to be representative of those on the bonded wide-body fuselage test article designed and built in the PABST program. Tests conducted in this report show that bondline flaws loaded primarily in shear did not grow whereas those loaded by peel or tension forces did exhibit flaw growth. Flaw growth rate was higher at the slow rate of two cycles per hour than for a fast-cycle rate of 30 Hz. Bondline flaws grew incrementally with load cycles and could be tracked by state-of-the-art NDE. Author (GRA)

N79-24164# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
PREPARATION OF POLY(DINITROPROPYL VINYL ETHER) WITH CROSSLINKING SITES, FOR USE AS A CASTABLE BINDER Final Report
G. W. Lawrence and H. G. Adolph 1 Dec. 1978 49 p
(AD-A066079; NSWC/WOL/TR-78-120; AFATL-TR-78-86)
Avail: NTIS HC A03/MF A01 CSCL 11/9

Attempts were made to prepare dinitropropyl vinyl ether (DNPVE) prepolymers of a molecular weight range of 2,000 to 4,000 with hydroxy functionality for use in cast-curable energetic binder systems. Two approaches were pursued. First, part of the dinitropropyl side chains in Poly-DNPVE were reduced to monoitropropyl groups and then hydroxymethylated with aqueous formaldehyde. The desired hydroxy-functional polymer was formed in excellent yield. In a second approach, DNPVE monomer was polymerized using initiator systems capable of introducing functional groups. The system, epichlorohydrin/SnC14/DNPVE, gave an incompletely characterized product of the expected elemental composition. However, the structure of the product was not determined. Author (GRA)

N79-24165# Pennsylvania State Univ., University Park. Dept. of Chemistry.
THE REACTION OF PHENYLLITHIUM WITH POLY-(DICHLOROPHOSPHAZENE) Interim Technical Report
H. R. Allcock and C. Ting-Wah Chu 8 Mar. 1979 28 p refs
(Contract N00014-75-C-0685)
(AD-A066183; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/3

The reactions between polydichlorophosphazene, (npcl2)n, leads to both halogen substitution and chain cleavage. A new series of polymers was prepared when 10% of the chlorine atoms were replaced by phenyl groups and the remaining halogen in then replaced by trifluoroethoxy or butyl -amino groups. Author (GRA)

N79-24166# California Research and Technology, Inc., Woodland Hills.
NUMERICAL INVESTIGATIONS OF FRACTURE AND MICRO-MECHANICS IN CERAMICS Final Report, 15 Sep. 1977 - 14 Sep. 1978
Y. Marvin Ito, Martin Rosenblatt, Larry DeAngelo, and Louis Y. Cheng Jan. 1979 68 p refs
(Contract N00014-77-C-0790)
(AD-A066252) Avail: NTIS HC A04/MF A01 CSCL 11/2

This document contains three technical papers: (1) 'Surface Flaw Effects on Crack Propagation from Subsonic Water Drop Impact'. The effects of surface flaws on ceramic target damage from subsonic water drop impacts are investigated using numerical code simulations based on fundamental wave propagation and fracture mechanics concepts. (2) 'Effects of Surface Pores in Silicon Nitride Impacted by a Water Drop. A water drop impacting directly on a surface pore may significantly increase the probability of crack formation and growth near the pore boundary. (3) 'Strain Energy Release Associated with Circumferential Cracks Around Embedded Particles'. Numerical code simulations are used to determine the strain energy release associated with circumferential cracks around spherical particles embedded in tension within homogeneous matrix materials. GRA

N79-24167# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Polymer Branch.
SYNTHESIS AND PROPERTIES OF BENZIL END-CAPPED ACETYLENE TERMINATED PHENYLQUINOXALINES (BATQs) Final Technical Report, Oct. 1976 - Oct. 1978
F. L. Hedberg and F. E. Arnold Dec. 1978 19 p refs
(AF Proj. 2419)
(AD-A066335; AFML-TR-78-142) Avail: NTIS HF A02/MF A01 CSCL 11/9

A series of new acetylene-terminated phenylquinoxaline materials has been prepared utilizing 4-(3-ethynylphenoxy)benzil. The amorphous materials with molecular weights from 500 to 1460 exhibited softening in the 25 - 160 C range with a strong polymerization exotherm reaching a maximum at 270 - 290 C. The addition nonvolatile cure provides thermoset systems which show excellent thermoxidative stability for high temperature matrix and adhesive resins. Reactive diluents have been synthesized which are completely compatible and provided additives for melt processability. Author (GRA)

N79-24168# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Polymer Branch.
POLYMERIC MATERIALS CONTAINING AROMATIC ENYNE LINKAGES Final Technical Report, Sep. 1977 - Sep. 1978
B. A. Reinhardt and F. E. Arnold Dec. 1978 29 p refs
(AF Proj. 2419)
(AD-A066334; AFML-TR-78-141) Avail: NTIS HC A03/MF A01 CSCL 11/9

High molecular weight polysulfones containing 1, 3-enyne linkages within the polymer backbone were prepared by the reaction of the potassium salts of (E)-3, 3:-(1-buten-3-ynylene) diphenol and 4,4:-dihydroxybiphenyl with 4,4:-dihalosulfones in DMSO-sulfolane solvent mixtures. The polymers were soluble in methylene chloride and exhibited inherent viscosities as high as 0.74 (0.5% solution in DMAC at 30 C) with glass transition temperatures ranging from 179 to 214 C. It was postulated that the polymers upon heating would curve via an intramolecular cycloaddition reaction to form a 2-phenylnaphthalene fused ring system along the polymer backbone. Preliminary thermal analytical data and studies on cured films indicate that the primary curing reaction is intermolecular in nature rather than intramolecular. Additional data indicate that the enyne polysulfones have suitable properties for use as high temperature thermoplastic composite materials. Author (GRA)

N79-24169# Air Force Academy, Colo. Research Lab.
AIRCRAFT ENGINE OIL ANALYSIS BY NEUTRON ACTIVATION TECHNIQUES Summary Report
Thomas A. Menard Dec. 1978 60 p refs
(AF Proj. 2303)
(AD-A066202; FJSRL-TR-78-0016) Avail: NTIS HC A04/MF A01 CSCL 11/8

At the present time all three military services use the Spectrometric Oil Analysis Program (SOAP) for the routine analysis of engine oil samples. The purpose of this program is to continually monitor the amounts of wear metal contaminants found in engine oil as an indicator of engine wear and possible engine failure. Use of such a program results in large savings by extending the time between oil changes and, more importantly, by indicating when engines should be taken out of service for preventive maintenance. The current program uses either atomic emission or atomic absorption for the analysis. The problems associated with the current methods are twofold. First, the instruments require a laboratory environment and the results from a particular sample may take days to return to the user. Under these conditions an engine might be operated to failure before notification of a failed oil sample. Secondly, the instruments are fairly expensive. This report summarizes the research which was done using Californium-252 as a neutron source in order to determine the feasibility of using such a source for analyzing USAF aircraft engine oil samples by neutron activation techniques. The desired solution would be an inexpensive facility which could be located on every flightline and provide the individual concentration of 13 different elements in each oil sample prior to the aircraft being flown again. GRA

N79-24170# Battelle Columbus Labs., Ohio.
HELIOSTAT GLASS SURVEY AND ANALYSIS
M. A. Lind and J. M. Rusin Sep. 1978 88 p refs
(Contracts EY-76-C-04-0789; EY-76-C-06-1830)
(PNL-2868) Avail: NTIS HC A05/MF A01

A comprehensive survey of both foreign and domestic sources of low distortion, high transmission flat glass with a nominal thickness of 3 mm was undertaken. The characteristics, availability, and cost of glass for use in second surface heliostat mirrors for the Barstow pilot plant and future commercial central receiver plants were examined. Information obtained from the manufacturers and the results of investigation performed at Sandia Laboratories at Albuquerque and Livermore were compiled with the PNL characterization data to generate the specifications for the GFE glass to be used in the Barstow pilot plant. Eleven different flat glass samples from seven of the domestic sources and one foreign source were characterized for solar transmittance, flatness, and durability. The samples were representative of four different manufacturing processes: float, fusion, rolled, and twin ground. The results and implication of these glass characterization studies and a brief summary of the manufacturer survey are presented. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-24171 Utah Univ., Salt Lake City.
HYDROPYROLYSIS OF COAL DERIVED LIQUIDS AND RELATED MODEL COMPOUNDS Ph.D. Thesis
Ramasamy Ramakrishnan 1978 160 p
Avail: Univ. Microfilms Order No. 7902481

The development of a new process for upgrading of coal liquids and other heavy oils into liquids and/or C2-C4 gaseous products involving hydropyrolysis in the temperature range of 500 to 650 C and hydrogen pressures of 120 to 2250 psig is presented. Three types of starting feeds, including model compounds, were employed: (1) normal paraffins, in particular, n-hexadecane; (2) polycyclic naphthenes, in particular, decalin; and (3) coal liquids and other heavy oils or solids. A special reactor for hydropyrolysis under quantative conditions was designed and constructed. The change in product composition as a function of feedstock chemical structure, and of experimental conditions, was investigated, and mechanistic aspects of the thermal hydrocracking process elucidated. Dissert. Abstr.

N79-24172*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN AND EVALUATION OF AIRCRAFT HEAT SOURCE SYSTEMS FOR USE WITH HIGH-FREEZING POINT FUELS Final Report
A. J. Pasion NASA May 1979 53 p refs
(Contract NAS3-20815)
(NASA-CR-159568; D6-48097) Avail: NTIS HC A03/MF A01 CSCL 21D

The objectives were the design, performance and economic analyses of practical aircraft fuel heating systems that would permit the use of high freezing-point fuels on long-range aircraft. Two hypothetical hydrocarbon fuels with freezing points of -29 C and -18 C were used to represent the variation from current day jet fuels. A Boeing 747-200 with JT9D-7/7A engines was used as the baseline aircraft. A 9300 Km mission was used as the mission length from which the heat requirements to maintain the fuel above its freezing point was based. J.A.M.

N79-24173# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
SOLID PROPELLANT COMBUSTION MECHANISM RESEARCH Annual Report, 1977 - 1978
L. H. Caveny, M. BenReuven, J. Bellan, and M. Summerfield Apr. 1978 35 p refs
(Contract N00014-75-C-0705)
(AD-A065761; AMS-1373) Avail: NTIS HC A03/MF A01 CSCL 21/9

The combustion processes of solid propellants and rocket

chamber flows are being analyzed in terms of more complete flame models and fluid dynamics models. The flame structure, surface processes, and liquid layer decomposition of a cyclic nitramine (e.g., RDX) have been modeled. The model includes the partial decomposition of the nitramine molecule in the liquid phase, surface gasification, gas phase decomposition, and oxidation of formaldehyde. Several propellants (e.g., nitramine composite and nitrocellulose-based propellants) produce flame zones which extend well into the main chamber flow field. An analytical model is being developed that considers the effects of chemical reactions (i.e., extended flame zones) in the main chamber flow on the acoustic response of solid rocket motors.
Author (GRA)

N79-24174# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
ROTATING VALVE FOR VELOCITY COUPLED COMBUSTION RESPONSE MEASUREMENTS Annual Technical Report, 1 Jan. 1978 - 9 Jan. 1979
R. S. Brown and R. C. Waugh 24 Feb. 1979 53 p refs
(Contract F49620-77-C-0048; AF Proj. 2308)
(AD-A065741; CSD-2624-ISR-2; AFOSR-79-0247TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

Coupling between the combustion process and the acoustics of the combustion chamber are important factors determining combustion stability of a solid propellant rocket. This coupling results from the response of the combustion process to both the local acoustic pressure and the local acoustic velocity. Because of the complexity of both processes, they cannot be totally characterized analytically; therefore, laboratory test data are needed in making analytical combustion stability predictions. Analytical studies accomplished under this contract have developed a mathematical analysis of the transient ballistics. The solution of the transient mass, momentum, and energy equations incorporates both linear and nonlinear velocity coupling, as well as pressure coupling, particle damping, flow turning, and nozzle losses in the analysis. The analysis shows that velocity coupling dominates the system response when the two valves operate 180 deg. out of phase. Combustion tests were conducted using two nonaluminized propellants. Analysis of the data, using the linear velocity response model, indicates the imaginary part of the response increases from approximately -10 at 150 Hz to approximately 1.6 at 570 Hz. Amplitude spectrum analyses of the pressure traces show significant harmonic content. Since the area wave form contains very low harmonic content, this suggests the nonlinear velocity coupling may provide a more realistic framework for data interpretation. Combustion tests were also conducted with a formulation containing 21% aluminum. With the exception of one slot insert, the apparatus operated satisfactorily. GRA

N79-24175# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
SENSITIVITY OF BURNING RATE TO INITIAL TEMPERATURE FOR A BINARY MAGNESIUM-SODIUM NITRATE MIX
Richard C. Strittmater, Hughes E. Holmes, and J. Richard Ward Dec. 1978 23 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A066119; AD-E430186; ARBRL-ME-02889) Avail: NTIS HC A02/MF A01 CSCL 19/1

The temperature sensitivity of the burning rate of a mixture of magnesium and sodium nitrate (60/40 by weight) was determined at 0.1 and 1.0 MPa. The temperature sensitivity was 0.0021/K and 0.0028/K at 0.1 MPa and 1.0 MPa, respectively. A standard JANNAF composite propellant illustrated the same trend in temperature sensitivity with increasing pressure leading one to suggest the models used for composite propellant combustion are the starting point for modeling pyrotechnic combustion. Analysis of various combustion models suggests the dependence of temperature sensitivity with initial temperature as an additional tool to determine the capability of various models to describe combustion. At present the temperature sensitivity is assumed to be independent of initial temperature; experiments need to be performed over large temperature intervals in order to test this hypothesis. Pyrotechnics offer an attractive test case, since the initial temperature of a pyrotechnic can be raised to nearly 1000K before decomposition of the oxidizer or phase changes take place. Author (GRA)

N79-24176# Lehigh Univ., Bethlehem, Pa.
DEVELOPMENT OF A MODULAR SOFTWARE SYSTEM FOR THE DYNAMIC SIMULATION OF COAL CONVERSION PLANTS Quarterly Report, Apr. - Jun. 1978
William E. Schiesser, F. P. Stein, S. H. Johnson, H. S. Caram, G. R. Dissinger, and K. L. Chen Jul. 1978 31 p refs
(Contract EX-76-C-01-2338)
(FE-2338-10) Avail: NTIS HC A03/MF A01

Development of the general DSS/2 code continued in three directions: (1) a manual was completed for the application of DSS/2 to partial differential equations (PDEs) in cylindrical and spherical coordinates, (2) alternative methods for approximating the first-order spatial derivatives in PDEs describing flow-through systems, e.g., tubular reactions, heat exchangers are programmed and given a preliminary test, and (3) the Harwell and Yale sparse matrix codes are being implemented on the Lehigh computer in case and implicit integrator based on sparse matrix methods is later required. New coding was added to the methanator model to readjust the reaction conversions if one or more of the reactants are consumed in a reactor. The new steady-state condition was confirmed to be accurate by an independent program. Simulation of the hydrogen plant was initiated. The first unit to be modeled is the steam reformer in which reactions are limited not by kinetics but by heat transfer. DOE

N79-24177# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INORGANIC HALOGEN OXIDIZER RESEARCH Final Report, 1 Apr. 1970 - 31 Dec. 1978
K. O. Christie Feb. 1979 659 p refs
(Contract N00014-70-C-0294)
(AD-A066149; RI/RD79-165) Avail: NTIS HC A99/MF A01 CSCL 21/9

A basic research program was carried out in the area of inorganic halogen oxidizers. The program resulted in 91 papers published in major technical journals, 23 papers presented at international and national meetings, and 14 issued and 4 pending U.S. patents. Major efforts included studies in the areas of nitrogen fluorides, halogen fluorides and oxyfluorides, perchlorates, novel onium salts and sulfur fluorides. In the area of nitrogen fluorides, the most significant breakthrough was achieved in NF4(+) salts and synthetic methods developed under this program have resulted in NF4(+) based solid propellant NF3-F2 gas generators for chemical HF-DF lasers. GRA

N79-24178# Department of Energy, Bartlesville, Okla. Energy Technology Center.
STABILITY CHARACTERISTICS OF HYDROCARBON FUELS FROM ALTERNATIVE SOURCES
Dennis W. Brinkman, M. L. Whisman, and John N. Bowden Mar. 1979 40 p refs
(BETC/RI-78/23) Avail: NTIS HC A03/MF A01

Two samples of gasoline and six samples of jet fuel derived from coal, tar sands or oil shale were subjected to accelerated storage stability tests at 43.3 and 93.3 C. Two samples of commercial, petroleum-based gasoline and one sample of a petroleum based jet fuel also were evaluated in this program for comparative purposes. DOE

N79-24179# Oklahoma State Univ., Stillwater. School of Chemical Engineering.
PHASE EQUILIBRIUM AND VOLUMETRIC PROPERTIES OF COAL-DERIVED FLUIDS Quarterly Report, 16 Mar. 1978 - 15 Jun. 1978
R. L. Robinson, Jr. 1978 16 p refs
(Contract EX-76-C-01-2278)
(FE-2278-9) Avail: NTIS HC A02/MF A01

Data acquisition proceeded on gas volumetric properties using the Burnett apparatus. Pure component compressibilities and virial coefficients were determined for He, H2, CH4, CO and CO2 at 100 C. Vapor-liquid equilibrium measurements at 220 and 400 F were made on the binary system methane-decane using the variable-volume, windowed phase equilibrium cell. These data were taken for comparison with data from the literature. Results indicate that the facility is operating reliably, although the

chromatograph calibration method requires further refinement.
DOE

N79-24180# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
DENSIFIED BIOMASS: A NEW FORM OF SOLID FUEL
Tom Reed and Becky Byrant Jul. 1978 44 p refs
(Contract EG-77-C-01-4042)
(SERI-35) Avail: NTIS HC A03/MF A01

Biomass is an economically and environmentally attractive fuel, but it is often difficult to collect, store, ship, and use. Densifying biomass to a specific gravity of 1.0 eliminates most of these fundamental problems and produces a uniform, clean, stable fuel: densified biomass fuel or DBF. Before conversion to DBF, raw biomass residues generally require preparation: the separation of noncombustibles from combustibles, expecially for solid municipal waste; milling; and drying. About 5% of the energy content in raw biomass can be expended in preparation and 1% to 3% in densification. In its densified form, biomass can be burned in standard equipment with reduced emissions and increased heat release and thermal efficiency. DOE

N79-24181# Catalytic, Inc., Wilsonville, Ala.
SOLVENT REFINED COAL (SRC) PROCESS: OPERATION OF SOLVENT REFINED COAL PILOT PLANT Quarterly Technical Progress Report, Jan. - Mar. 1978
H. E. Lewis, W. H. Weber, G. B. Usnick, W. R. Hollenack, H. W. Hooks, and R. G. Boykin Jul. 1978 166 p refs
(Contract EX-76-C-01-2270)
(FE-2270-34) Avail: NTIS HC A08/MF A01

Operating conditions and test results obtained at the Solvent Refined Coal pilot plant in Wilsonville, Alabama, during the first quarter of 1978 are summarized. Indiana V coal processing was continued. The yield of SRC was 46% of the MAF coal for a product containing 0.6 to 0.7 wt % sulfur. Process solvent was generated in consistently greater quantities than required to sustain steady-state operation. Tests confirming the high rate of Indiana V conversion at short residence times were completed. Coal conversion of 93% was attained at the slurry preheater when most of the hydrogen gas was bypassed around the preheater. Temperatures up to 850 F at the preheater outlet were investigated. A series of mineral residue separation experiments was conducted. DOE

N79-24182# Fluor Engineers and Constructors, Inc., Irvine, Calif.
CONCEPTUAL DESIGN FOR ADVANCED COAL LIQUEFACTION COMMERCIAL PLANT Final Report
Jun. 1978 73 p refs
(Contract EX-76-C-01-2251)
(FE-2251-52) Avail: NTIS HC A04/MF A01

A revised refining sequence employing catalytic cracking was developed for comparison to the base case which used hydrocracking. The refining sequence includes a distillate hydrotreater, a hydrocracker, a naphtha hydrotreater, a catalytic reformer, and an alkylation unit in addition to the catalytic cracking unit. Complete material and utility balances were developed and a capital cost estimate was prepared. Economics were then developed. The cost of gasoline produced in the alternate case was about $0.50 per barrel greater than the cost of gasoline in the base case. But this may not be conclusive in view of the approximate nature of the study. A purchased power case was considered in which a large block of electric power in purchesed for operating the plant along with 91 MW produced internally. The combined cycle gas turbine power plant included in the base case was eliminated and gas used to fire these turbines was converted to additional by-product SNG. DOE

N79-24183# Bechtel Corp., San Francisco, Calif.
ANALYSIS OF COAL HYDROGASIFICATION PROCESSES Quarterly Technical Progress Report, 1 Dec. 1977 - 28 Feb. 1978
Apr. 1978 60 p refs
(Contract EF-77-A-01-2565)
(FE-2565-13) Avail: NTIS HC A04/MF A01

Data from 15 recent Rocketdyne hydrogasification tests with subbituminous and bituminous coals and 24 Rocketdyne partial liquefaction tests with bituminous coals were entered into the computerized data base. Data from 17 recent Cities Service hydrogasification tests with subbituminous coal were also entered into the data base. The Cities Service, Rocketdyne, and PERC data bases were expanded to include values for the following: carbon selectivity to BTX (Cities Service); carbon selectivity to methane, ethane, and BTX (Rocketdyne); and gas velocity, gas residence time, and carbon selectivity to gas, methane, and ethane (PERC). Semiempirical correlations for predicting overall carbon conversion and carbon conversion to gas, methane, CO, and CO2 were fitted to the Cities Service and Rocketdyne subbituminous coal data. The analysis showed that the Cities Service bench-scale reactor and the Rocketdyne 1/4-ton/hr reactor give similar values of overall carbon conversion and carbon conversion to gaseous products under comparable operating conditions. DOE

N79-24184# Institute of Gas Technology, Chicago, Ill.
PIPELINE GAS FROM COAL-HYDROGENATION: IGT HYDROGASIFICATION PROCESS, PROJECT 9000 Quarterly Report, 1 Jan. - 31 Mar. 1978
Aug. 1978 147 p refs
(Contract EX-76-C-01-2434)
(FE-2434-29; QR-7) Avail: NTIS HC A07/MF A01

Tests were conducted, with HYGAS pilot plant, to obtain data on the operating conditions necessary for high char conversion at high throughputs, using Illinois No. 6 bituminous coal. Three tests, numbers 68, 69, and 70, were conducted. In addition, three major modifications were made to the HYGAS reactor to improve the operation of the steam--oxygen gasifier and to decrease fines loss from the reactor. After Test 70, the Institute of Gas Technology (IGT) made three modifications to the plant. A new, six-nozzle, steam-oxygen sparger design was installed, the 339 valve was relocated, and the installation of double-screening equipment in the coal feed area was completed. Other plant turnaround activities were also conducted during the time required for the above modifications. HYGAS personnel continued to supply Procon, Inc., with data to aid them in their design of a commercial/distribution HYGAS plant. IGT also made suggestions to Procon concerning the commercial plant reactor design. DOE

N79-24185# Colorado School of Mines, Golden. Dept. of Chemical and Petroleum Refining Engineering.
CLEAN SOLID AND LIQUID FUELS FROM COAL Quarterly Progress Report, Jan. - Mar. 1978
J. H. Gary, J. O. Golden, R. M. Baldwin, R. L. Bain, and D. W. Dickerhoof 15 May 1978 97 p refs
(Contract EX-76-C-01-2047)
(FE-2047-8) Avail: NTIS HC A05/MF A01

Three additional continuous coal conversion experiments were completed. The number of experiments was limited because of a vendor strike which delayed delivery of pump parts. The preliminary experiments to test system operability and to test for pressure and temperature effects were completed, and initial data reduction was finished. Conversion data for runs performed to date are presented. All experimental work has been completed for the CO-Steam catalyst investigation; the majority of the analytical workup is also complete. The results are summarized. In addition, preliminary results of conversion modelling are presented. Two extended experimental runs, each approximately 45 hours in duration, were completed on the HDN screening program. These runs comprise 2 of 3 runs runs needed to test for mass transfer effects in the trickle-bed reactor system before kinetic experiments can be made. DOE

N79-24186# City Coll. of the City Univ. of New York.
IMPROVED TECHNIQUES FOR GASIFYING COAL Quarterly Report, 1 Jan. - 31 Mar. 1978
Robert A. Graff, J. Yerushalmi, and A. LaCava Apr. 1978 65 p refs
(Contract EX-76-S-01-2340)
(FE-2340-7; QR-7) Avail: NTIS HC A04/MF A01

Experiments were conducted in the modified 6-inch system to delineate the boundary between the turbulent regime and the transport states, including the fast fluidized bed regime. The results throw light on the phenomenon of choking. Fluidization experiments in the fast bed regime with a relatively coarse solid confirm that to achieve stable and smooth fast fluidization of a coarse solid requires correspondingly higher gas velocities and

associated solid rates. The yields of light hydrocarbon are not affected by their continued contact with char in the vapor residence zone. Sixty-nine to 85% of the nitrogen and 84 to 91% of the sulfur in Ireland Mine coal are converted to volatile species during flash hydrogenation at 100 atm. The method of injecting tracer gas to serve as an internal standard was validated against the standard technique in which the tracer is premixed with the reaction gas. DOE

N79-24187# Purdue Univ., Lafayette, Ind.
SYSTEMS STUDIES OF COAL CONVERSION PROCESSES USING A REFERENCE SIMULATOR Quarterly Report, 1 Apr. - 30 Jun. 1978
G. V. Reklaitis, M. K. Sood, S. Raghavan, Y. Soni, B. W. Overturf, J. R. Ford, P. Buchanan, Wj Weide, Jr., C. R. Wilkinson, and J. Boo Aug. 1978 84 p refs
(Contract EX-76-C-01-2275)
(FE-2275-8) Avail: NTIS HC A05/MF A01

The simulation model of the hydrotreating process section successfully tested the integrated operation of the Simulation System including the physical properties subsystems and involving pseudocomponents and solids stream flows. The hydrotreating reactor model was modified to include improved temperature profile predictions. The plant capital cost estimation subsystem was redesigned to allow use as a stand alone package. The revised package includes a redesigned cost data bank, equipment costing programs, factored plant and auxiliary equipment programs as well as a profitability analysis routine. The physical properties package was updated by the addition of routines for the accurate estimation of the thermodynamic properties of steam. A steady state model of the methanation section were assembled. Scrubber, multi-phase separator, and turbine models was developed for the vapor recovery and heat recovery process sections. DOE

N79-24188# Oak Ridge National Lab., Tenn.
LOW Btu COAL GASIFICATION PROCESSES. VOLUME 1: SUMMARY, SCREENING, AND COMPARISONS
H. F. Hartman, J. P. Belk, and D. E. Reagan Nov. 1978 140 p refs
(Contract W-7405-eng-26)
(ORNL/ENG/TM-13-Vol-1) Avail: NTIS HC A07/MF A01

A survey was made of 102 reported processes that produce low and intermediate Btu gas from coal. Concise summaries were provided for 47 processes and include status, operating conditions, and a description of the gasifier. Characteristics of different types of gasification processes were compared, and specific comparisons were made for the processes that were investigated in depth. Other process considerations such as potential applications, problem areas, economics, and environmental considerations are discussed. DOE

N79-24189# Department of Energy, Bartlesville, Okla. Energy Technology Center.
MOTOR GASOLINES, SUMMER 1978
Ella Mae Shelton Feb. 1979 79 p refs
(BETC/PPS-79/1) Avail: NTIS HC A05/MF A01

Analytical data for 2,433 samples of motor gasoline, from service stations throughout the country, were collected and analyzed. The samples represent the products of 50 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing areas and districts into which the country is divided. A map shows marketing areas, districts and sampling locations. Charts indicating the trends of selected properties of motor fuels since 1946 are included. Twelve octane distribution percent charts for areas 1, 2, 3, and 4 for unleaded, regular, and premium grades of gasoline are presented. The antiknock (octane) index ((R + M)/2) averages of gasolines sold in this country were 88.5, 89.5 and 94.3 for unleaded, regular, and premium grades of gasolines, respectively. DOE

N79-24190# Mobil Research and Development Corp., Paulsboro, N. J.
FLUID BED PROCESS STUDIES ON SELECTIVE CONVERSION OF METHANOL TO HIGH OCTANE GASOLINE Final Report
A. Y. Kam Apr. 1978 264 p refs
(Contract EX-76-C-01-2490)
(FE-2490-15) Avail: NTIS HC A12/MF A01

The Mobil fluid bed methanol-to-gasoline process was successfully scaled-up to a 4 barrel-a-day pilot plant. Gasoline selectivity is higher than 88 wt% of hydrocarbons produced, and the octane rating is 96. Gasoline quality is excellent and exceeds all the requirements of unleaded regular gasoline. With this demonstration accomplished, the process is now ready for scale-up to a 100 B/D pilot plant, the final step before constructing commercial size facilities. Methanol was completely converted at design conditions. Steady state operations were demonstrated, and gasoline yield and quality were optimized. Process variable studies showed that durene yields increased with pressure and decreased with temperature. Several process concepts including light gas recycle, co-feeding liquid/vapor methanol, and heat removal from the fluid bed were evaluated. A process design basis for a large unit was developed. DOE

N79-24191# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
EXHAUST EMISSIONS AND FUEL ECONOMY FROM AUTOMOBILES USING ALCOHOL/GASOLINE BLENDS UNDER HIGH-ALTITUDE CONDITIONS
David Richardson Oct. 1978 28 p
(PB-290612/1; TAEB-79-1) Avail: NTIS HC A03/MF A01 CSCL 21D

Results of emissions tests on ten passenger cars operated on fuel blends containing methanol and ethanol are described. The purpose of the program was to determine the immediate exhaust emission and fuel economy changes due to use of alcohol/gasoline blends under high altitude conditions. The vehicles represented the 1973-1978 model years and were randomly selected from private owners in the Denver area. The test procedures used were the federal test procedure (exhaust emissions only) and the highway fuel economy test. Fuel economy was measured and recorded using the carbon balance technique. GRA

N79-24192# General Accounting Office, Washington, D. C. Energy and Minerals Div.
US REFINING CAPACITY: HOW MUCH IS ENOUGH Report to the Congress
15 Jan. 1979 62 p refs
(PB-291437/2; EMD-78-77) Avail: NTIS HC A04/MF A01 CSCL 21D

From 83 to 92 percent of the Nation's petroleum products were provided from U.S.-based refineries. Between now and 1985, the U.S. refining industry is planning capacity additions which should maintain this position. Whether or not refinery additions should take place will involve domestic and international tradeoffs. This report discusses petroleum product demand, industry expansion plans, and Federal policies affecting those plans. GRA

N79-24193# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
GASOHOL TEST PROGRAM
Richard Lawrence Dec. 1978 42 p
(PB-290569/3; TAEB-79-4A) Avail: NTIS HC A03/MF A01 CSCL 21D

Eleven vehicles (4 three-way systems and 7 oxidation catalyst systems) were tested on five fuels. A summer grade gasoline was selected as the base fuel and was used both before and after testing on the two commercial gasohols. Indolene and a gasohol fuel containing indolene and ethanol were the other two fuels. All gasohol fuels used in this program contained 10 percent ethanol (by volume). Duplicate tests were planned on four fuels and four tests were planned on the base fuel. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-24194 Texas A&M Univ., College Station.
OPTIMIZATION OF THE SECOND ORDER LOGARITHMIC

MACHINE ECONOMICS PROBLEMS BY EXTENDED GEOMETRIC PROGRAMMING Ph.D. Thesis
Clarence Lee Hough, Jr. 1978 131 p
Avail: Univ. Microfilms Order No. 7909205

The theory of geometric programming is extended to include a new function with logarithmic exponents. The function, defined as a Quadratic Posylognomial (QPL) is a series of nonlinear product terms with positive coefficients and positive variables. The primal-dual relationships and necessary conditions are designed and special cases wodre sufficient conditions exist are derived. The constrained Machining Economics Problem (MEP) using second order logarithmic tool life equations are characterized and formulated using the above theory. An algorithm to solve special cases that meet the sufficient conditions with single term posynomial constraints is developed. A peripheral end milling example problem, based on experimental tool life data, was solved using the algorithm. The QPL formulation using second order tool life models was conpared to the posynomial formulation using extended Taylor tool life models. Dissert. Abstr.

N79-24195 Ohio State Univ., Columbus.
DEVELOPMENT AND IMPLEMENTATION OF PRODUCTIVITY MEASUREMENT SYSTEMS WITH EMPHASIS ON INTERORGANIZATION RELATIONSHIPS Ph.D. Thesis
David Scott Sink 1978 574 p
Avail: Univ. Microfilms Order No. 7908217

Emphasis is placed on development of productivity measurement and improvement systems as management or decision aids for organization/environment relationships. The methodology utilized to design and develop the systems incorporates action research concepts and application of structured group methods. The methodology was developed and tested during previous research in four major public sector organizations. The basic methodology was further expanded to incorporate considerations for implementation and organization/environment relationships. The expanded methodology was applied in six various organizations: two public school districts, one private sector manufacturing firm, one public sector small municipality, one medical educational consortium, and one home economics extension service organization. Approximately 130 persons participated in the application of this methodology. The results of these experiences are discussed and evaluated. Dissert. Abstr.

N79-24196 Texas Univ. at Austin.
FLEXURAL BEHAVIOR OF REINFORCED SULFUR-INFILTRATED CONCRETE BEAMS Ph.D Thesis
Bancha Suparinayok 1978 245 p
Avail: Univ. Microfilms Order No. 7911036

The sulfur-infiltrated concrete (SIC) beams were reinforced with different percentages of compression and tension steel and had different depths of sulfur infiltration. The influence of the shear span-to-depth ratio and the amount of web reinforcement on shear strength was studied. The splitting tensile strength and the modulus of elasticity were found to vary with the square root of the compressive strength of concrete. The strengths of SIC beams were found to be higher than of conventional beams for the same amount of reinforcement. The stress-strain curves generated from strain readings may be represented by a polynomial function of strain; i.e., the SIC stress was a function of SIC strain alone. An assumed triangular stress distribution in the compression zone was found to be satisfactory for estimating the ultimate strength and the load-deflection response of SIC beams. Dissert. Abstr.

N79-24197*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR PRODUCING CONCENTRIC HOLLOW SPHERES Patent Application
Taylor G. Wang (JPL) and Daniel D. Elleman, inventors (to NASA) (JPL) Filed 8 May 1979 15 p
(Contract NAS7-100)
(NASA-Case-NPO-14596-1; US-Patent-Appl-SN-037072) Avail: NTIS HC A02/MF A01 CSCL 13H

Hollow spheres with precisely concentric inner and outer spherical surfaces are formed by applying vibrations to a nonconcentric hollow sphere while it is at an elevated temperature at which it is fluid or plastic. The vibrations produce internal flows which cause the inner and outer surfaces to become precisely concentric. Concentric spheres can be mass produced by extruding a material such as glass or metal while injecting a stream of gas into the center of the extrusion to form a gas-filled tube. Vibrations are applied to the extruded tube to help break it up into individual hollow bodies of a desired uniform size. The bodies tending to form spherical inner and outer surfaces. NASA

N79-24198# Naval Civil Engineering Lab., Port Hueneme, Calif.
COEFFICIENTS OF FRICTION BETWEEN CALCAREOUS SANDS AND SOME BUILDING MATERIALS, AND THEIR SIGNIFICANCE Final Report, Oct. 1977 - Sep. 1978
P. J. Valent Jan. 1979 34 p refs
(AD-A066297; CEL-TN-1542) Avail: NTIS HC A03/MF A01 CSCL 13/3

Friction tests of a coralline and an oolitic sand and a foraminiferal sand-silt against smooth and rough steel and concrete surfaces were run in a modified soils direct shear machine. Friction test results for these calcareous materials did not differ markedly from the results for a quartz sand. These results indicate that there is nothing inherently different in the capability of these calcareous materials to develop frictional forces on typical building material surfaces - when compared to quartz-predominant sands - except that some calcareous materials experience large volume decreases during shear. These large volume decreases would impair the development of high effective normal stresses against the building material surface, resulting in low friction forces on piles, some anchors, and penetrometers in calcareous materials. This latter hypothesis is stated, but not directly addressed in this reported work. Author (GRA)

N79-24199# Pennsylvania State Univ., University Park.
DEVELOPMENT OF MEASUREMENT TECHNIQUES FOR MONITORING CHEMICAL PURITY OF MATERIALS USED IN DIGITAL IC PROCESSING Final Report, Sep. 1974 - Dec. 1976
J. Stach, M. B. Das, and R. E. Tressler Sep. 1978 88 p refs (Contract NBS-5-35717; ARPA Order 2397)
(PB-291427/3; NBS-GCR-78-134) Avail: NTIS HC A05/MF A01 CSCL 13H

The transport of impurities from specially prepared boron nitride diffusion sources onto silicon slices was investigated. The sources were of varying degrees of purity. No transport was detected by thermally stimulated capacitance and current measurements having an estimated detection limit of 10 to the 11th power/cc. The kinetics of silicon thermal oxidation in the presence of chlorine, from HCl gas or from trichloroethylene vapor, were studied using the SOLGAS computer program. Calculated data are presented to show the equilibrium partial pressures of the various chemical species in the diffusion furnace atmosphere as a function of temperature in the range 800 to 1300 C for a variety of mixtures of gases. GRA

N79-24200# National Bureau of Standards, Washington, D. C. National Engineering Lab.
MEASUREMENT ASSURANCE FOR GAGE BLOCKS Final Report
Carroll Croakin, John Beers, and Clyde Tucker Feb. 1979 83 p refs
(PB-292020/5; NBS/MONO-163; LC-78-600162) Avail: NTIS HC A05/MF A01 CSCL 14B

A general discussion of the philosophy of measurement assurance is given. Then three levels of measurement assurance programs are outlined showing how control over the measurement process can be maintained and how the offset (or systematic error) from the unit of length maintained by the National Bureau of Standards can be made negligible. GRA

N79-24201# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: EFFECTS ON BUILDINGS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 82 p Supersedes NTIS/PS-78/0239; NTIS/PS-77/0219; NTIS/PS-76/0176
(NTIS/PS-79/0265/3; NTIS/PS-78/0239; NTIS/PS-77/0219; NTIS/PS-76/0176) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Research findings are cited on the effects of sonic booms

on buildings, structural components, forms, windows, and walls. Test-house investigations are included, along with damage analysis and vibration response. Documentation is made on residential buildings. Other topics contained in the volume range from theory to failure analysis. GRA

N79-24202# Advisory Group for Aerospace Research and Development, Paris (France).
RESEARCH AND DEVELOPMENT ACTIVITIES IN ITALY IN THE FIELD OF AEROSPACE STRUCTURES AND MATERIALS
L. Lazzarino (Pisa Univ., Italy) Mar. 1979 27 p refs Presented at the 47th Meeting of the AGARD Structures and Mater. Panel, Florence, Italy, 25 Sep. 1978
(AGARD-R-675; ISBN-92-835-1315-0) Avail: NTIS HC A03/MF A01

The activities concerned with metallic and nonmetallic aerospace materials along with the fields of stress analysis, vibrations and aeroelasticity, fatigue and crack propagation, and particularly, interesting work aimed at resolving design problems and at facilitating the introduction of new technologies. The main facilities developed are indicated. M.M.M.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N79-24203* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH-TEMPERATURE MICROPHONE SYSTEM Patent
Allan J. Zuckerwar, inventor (to NASA) (Old Dominion Univ., Norfolk, Va.) Issued 17 Apr. 1979 10 p Filed 28 Apr. 1978 Supersedes N78-23275 (16 -14, p 1831) Sponsored by NASA
(NASA-Case-LAR-12375-1; US-Patent-4,149,423; US-Patent-Appl-SN-900842; US-Patent-Class-73-724; US-Patent-Class-73-647) Avail: US Patent and Trademark Office CSCL 17B

Pressure fluctuations in air or other gases in an area of elevated temperature are measured using a condenser microphone located in the area of elevated temperature and electronics for processing changes in the microphone capacitance located outside the area the area and connected to the microphone by means of high-temperature cable assembly. The microphone includes apparatus for decreasing the undesirable change in microphone sensitivity at high temperatures. The high temperature cable assembly operates as a half-wavelength transmission line in an AM carrier system and maintains a large temperature gradient between the two ends of the cable assembly. The processing electronics utilizes a voltage controlled oscillator for automatic tuning thereby increasing the sensitivity of the measuring apparatus.

Official Gazette of the U.S. Patent and Trademark Office

N79-24204 Mississippi Univ., University.
NUMERICAL COMPUTATION OF ELECTROMAGNETIC SCATTERING BY INHOMOGENEOUS PENETRABLE BODIES Ph.D. Thesis
Srinivasiengar Govind 1978 209 p
Avail: Univ. Microfilms Order No. 7910470

Different approaches for studying scattering by inhomogeneous dielectric bodies are considered. The unimoment method, a differential equation approach, and the integral equation approach are discussed in detail. For layer inhomogeneities, the overall system matrix is block tridiagonal, the solution of which can be obtained through an iterative procedure. The procedure is applied first for solving for the surface currents on layered spheres. The procedure is next extended to the determination of the current on a missile in the presence of a trailing inhomogeneous exhaust plume. Dissert. Abstr.

N79-24205 Southern Methodist Univ., Dallas, Tex.
DIRECT SEQUENCE SPREAD SPECTRUM SIGNALLING Ph.D. Thesis
Anant Kumar Jain 1978 180 p
Avail: Univ. Microfilms Order No. 7911218

The problems encountered in the Direct Sequence Spread Spectrum coding for communication systems employing widely distributed radio elements, providing area coverage, using higher order modulation techniques, multiple data rates, and requiring multiple access are addressed. A simple baseband correlation model which is subsequently modified to allow baseband correlation of higher order modulations is presented. Suitable algorithms are developed to generate codes and to select the best complementary pair in a multiple data rate environment, using Minimum Shift Keyed Chip modulation. An analog signal processing model and several examples showing how such a model is valuable in analyzing the performance of a Direct Sequence Spread Spectrum system when it is subjected to some known distortions are provided. Several examples indicative of what can be achieved with the state-of-the-art technology, which should be of significant use to those interested in pursuing further work in this area were studied. Dissert. Abstr.

N79-24206 Texas A&M Univ., College Station.
MULTIPLE ANTENNA BEAM FORMATION TECHNIQUES FOR SYNTHETIC APERTURE RADAR Ph.D. Thesis
Buford Randall Jean 1978 180 p
Avail: Univ. Microfilms Order No. 7909209

A novel system concept for a multiple antenna beam synthetic aperture radar (SAR) is explored and developed for earth observation applications from an orbital spacecraft platform. The multiple beam concept is shown to offer improved performance characteristics over conventional side-looking SAR systems. Advantages of the multiple beam SAR include conserving transmitter peak power, relaxing system design constraints for avoiding ambiguous radar return signals, reducing the dynamic range requirement for the radar receiver and signal processor, and providing wide swath coverage at a nearly constant incident angle. An analysis of the modulation and resolution characteristics of the radar return signal relating to the synthetic aperture signal requirements for the design of a multiple beam antenna array is reported. Methods for multiple beam formation are discussed and a design example is presented to illustrate and identify important design implementation considerations. Dissert. Abstr.

N79-24207 New Mexico State Univ., University Park.
REAL-TIME VIDEO FILTERING WITH BIT-SLICE MICROPROGRAMMABLE PROCESSORS Ph.D. Thesis
Robert Barclay Rogers 1978 115 p
Avail: Univ. Microfilms Order No. 7909472

Bit-slice microprogrammable processors and algorithms are developed to perform high-speed real-time video filtering of arbitrary scenes as part of a real-time videotheodolite system. Hardware and software components are designed to perform intelligent image discrimination and predictive tracking functions. A tracking window concept is introduced as the basic image partitioning tool. Statistics are derived from the observed scene through histograms of pixel occurrence in the three regions of a tracking window and are subsequently used to derive thresholding and Bayesian pixel classification rules on a dynamic basis. A mathematical technique for calculating the priori probability density functions of superimposed opaque components of an arbitrary scene is presented. Digital equipment is designed to implement the data acquisition and control functions for video filtering applications. Dissert. Abstr.

N79-24208 Connecticut Univ., Storrs.
NOISE PERFORMANCE OF BROADBAND AMPLIFIERS FOR USE WITH ELECTRICALLY SMALL ANTENNAS Ph.D. Thesis
Robert Arthur Sainati 1978 383 p
Avail: Univ. Microfilms Order No. 7911406

One of the key factors in evaluating noise performance is the external electromagnetic noise level assumed to exist at the receiving site. The noise level proposed accounts for the variability of the external noise with location, season, and time of day. The levels presented are quite conservative but ensure that a system meeting the level will be externally noise limited

for virtually any circumstance. Equations are developed which allow rapid but accurate determination of noise performance for field effect and bipolar junction transistors. Results of an analysis basic antenna-amplifier combinations show that a certain minimum size antenna is needed to meet the performance goals. For smaller antennas, various techniques for improving performance are analyzed. Dissert. Abstr.

N79-24209 Mississippi State Univ., State College.
FEEDBACK COMMUNICATIONS USING CODING IN THE FORWARD LINK Ph.D. Thesis
Sidney Griffin Williams 1978 102 p
Avail: Univ. Microfilms Order No. 7909341

Feedback can be employed and messages with detectable (but not correctable) bit error patterns can be repeated, effectively eliminating these types of errors. This is done in exchange for a generally lower information transfer rate. An m out of l (MOL) feedback scheme was developed which offers an alternative. For the MOL scheme, messages are organized into multimessage frames with m (one or more) additional messages allowed for repeating meassages from the previous frame. If m can be kept small in comparison to the frame length, the information rate will not suffer badly. The results show, even with low values of m, that most errors falling into detectable (but not correctable) bit error patterns can be corrected, thereby drastically reducing the system error rates. Dissert. Abstr.

N79-24210* National Aeronautics and Space Administration. Pasadena Office, Calif.
PHASE CONJUGATION METHOD AND APPARATUS FOR AN ACTIVE RETRODIRECTIVE ANTENNA ARRAY Patent
Robert C. Tausworthe (JPL) and Ralph C. Chernoff, inventors (to NASA) (JPL) Issued 3 Apr. 1979 14 p Filed 16 Mar. 1977 Supersedes N77-24340 (15 - 15, p 1976) Sponsored by NASA
(NASA-Case-NPO-13641-1; US-Patent-4,148,031; US-Patent-Appl-SN-777983; US-Patent-Class-343-100TD) Avail: US Patent and Trademark Office CSCL 09C

An active retrodirective antenna array wherein a reference array element is used to generate a phase reference which is replicated at succeeding elements of the array. Each element of the array is associated with a phase regeneration circuit and the phase conjugation circuitry of an adjacent element. In one implementation, the phase reference circuit operates on the input signal at the reference element, a voltage controlled oscillator (VCO) output signal and the input pilot signal at the next array element received from a transmission line. By proper filtering and mixing, a phase component may be produced to which the VCO may be locked to produce the phase conjugate of the pilot signal at the next array element plus a transmission line delay. In another implementation, particularly suited for large arrays in space, two different input pilot frequencies are employed.
Official Gazette of the U.S. Patent and Trademark Office

N79-24211# Ohio State Univ., Columbus. Electroscience Lab.
AN ANALYSIS OF THE MUTUAL COUPLING BETWEEN ANTENNAS ON A SMOOTH CONVEX SURFACE Final Report
P. H. Pathak and N. N. Wang Oct. 1978 96 p refs
(Contract N62269-76-C-0554)
(AD-A065591; ESL-(78)4583-7; NADC-79046-30) Avail: NTIS HC A05/MF A01 CSCL 09/5

A simple, approximate, asymptotic high frequency result is developed in this paper for the electromagnetic surface fields excited by infinitesimal electric or magnetic current sources which are placed on a smooth, perfectly-conducting convex surface of any shape. These surface fields propagate along Keller's surface ray paths, and their asymptotic description is uniformly valid along the ray including the immediate vicinity of the source. Furthermore, as the curvature of the surface becomes vanishingly small, this result recovers the known, exact result for the fields on a planar, perfectly-conducting surface. The development of this result is heuristically based upon the form of the asymptotic solutions for the surface fields which are first obtained for the canonical circular cylinder and spherical geometries. These solutions are then generalized to the arbitrary convex surface via the local properties of wave propagation at high frequencies. The effect of torsion associated with the surface rays is clearly identified in this result through the presence of a factor T/k, where T is the surface ray torsion and k is the surface curvature along the ray direction. Some currently available numerical results based on this analysis are indicated for the circular cylinder case. GRA

N79-24212*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A HIGH-SPEED DATA LINK FOR MODERATE DISTANCES AND NOISY ENVIRONMENTS Patent Application
Michael W. Sievers, inventor (to NASA) (JPL) Filed 25 Apr. 1978 25 p Sponsored by NASA
(NASA-Case-NPO-14152-1; US-Patent-Appl-SN-899828) Avail: NTIS HC A02/MF A01 CSCL 17B

A full duplex, high-speed data link is described which comprises identical modules at each site for communication over coaxial cables. Each module has a digital frequency modulation with a first-in-first out (FIFO) data buffer for data from a digital system to be transmitted over a cable and a receiver with an FIFO data buffer for data received for a digital system at the other end of the cable. Data words are preceded by a sync word which enables the receiver. Every word transmitted, including the sync word is stored in the FIFO data buffer. This arrangement using FIFO buffers allows for asynchronous transmission of data with receipt of the data beginning with the very first bit of the sync word. NASA

N79-24213*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITH. SUB-TASK 2: T SUB B MEASURED vs. T SUB B CALCULATED COMPARISON RESULTS Final Report
J. L. Kitzis and S. N. Kitzis 13 Apr. 1979 134 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158540; JPL-9950-40) Avail: NTIS HC A07/MF A01 CSCL 20N

Interim Antenna Pattern Correction (APC) brightness temperature measurements for all ten SMMR channels are compared with calculated values generated from surface truth data. Plots and associated statistics are presented for the available points of coincidence between SMMR and surface truth measurements acquired for the Gulf of Alaska SEASAT Experiment. The most important conclusions of the study deal with the apparent existence of different instrument biases for each SMMR channel, and their variation across the scan. L.S.

N79-24214# Ohio State Univ., Columbus. Electroscience Lab.
HIGH FREQUENCY NEAR FIELD SCATTERING BY AN ELLIPTIC DISK
Eric D. Greer and W. D. Burnside Dec. 1976 64 p refs
(Contract N62269-76-C-0554)
(AD-A065586; ESL-4583-1; NADC-79041-30) Avail: NTIS HC A04/MF A01 CSCL 09/5

The analysis of the high frequency radiation pattern of an antenna mounted near an elliptic disk is the object of this research. This is an analytic study of basic antenna types using GTD (ray optical) techniques. The elliptic disk is modelled as a perfectly conducting flat plate and patterns are taken in the far field. An equivalent current modification is introduced to correct caustic and pseudo-caustic regions where the GTD solution fails. The validity of the solution is shown by comparing the predicted pattern against measured results. The elliptic disk solution can be used to approximate antenna patterns of antenna mounted near arbitrary cross-section flat plates. This solution can also be used as part of an elliptic cylinder solution for aircraft and ship models. Author (GRA)

N79-24215# Ohio State Univ., Columbus. Electroscience Lab.
FUSELAGE-MOUNTED ANTENNA CODE: USER'S MANUAL
W. D. Burnside, R. J. Marhefka, and E. L. Pelton Jul. 1977

75 p refs
(Contract N62269-76-C-0554)
(AD-A065587; ESL-4583-2; ESL-784583; NADC-79042-30)
Avail: NTIS HC A04/MF A01 CSCL 09/5

This manual describes the input and output data associated with the volumetric computer code which has been delivered to the Naval Air Development Center. The input data is defined in general terms and applied to the Boeing 737 aircraft. Numerous examples are included to illustrate the various features of the computer code. Author (GRA)

N79-24216# Ohio State Univ., Columbus. Electroscience Lab.
WING-MOUNTED ANTENNA CODE: USER'S MANUAL
R. J. Marhefka and W. D. Burnside May 1978 86 p refs
(Contract N62269-76-C-0554)
(AD-A065589; ESL-(78)4583-5; NADC-79044-30) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report provides the necessary information to run a FORTRAN IV computer code which is used to analyze antenna patterns. The antenna can be in the presence of various structures which can be simulated by finite flat plates, an infinite ground plane, and a finite elliptic cylinder. For example, the radiation pattern of an antenna mounted on the wing of an aircraft can be analyzed. The computer code is theoretically based on the Geometrical Theory of Diffraction approach. Various examples are presented to illustrate the versatility of the code as well as its subtleties. Author (GRA)

N79-24217# Ohio State Univ., Columbus. Electroscience Lab.
AN ITERATIVE APPROACH FOR COMPUTING AN ANTENNA APERTURE DISTRIBUTION FROM GIVEN RADIATION PATTERN DATA
E. L. Pelton, R. J. Marhefka, and W. D. Burnside Jun. 1978 45 p refs
(Contract N62269-76-C-0554)
(AD-A065590; ESL-(78)4583-6; NADC-79045-30) Avail: NTIS HC A03/MF A01 CSCL 09/5

An iterative synthesis procedure is presented and applied to the problem of computing the complex aperture distribution of an antenna, given its far field magnitude pattern. The methods employed are applicable to antennas composed of either discrete or continuously distributed apertures, flush-mounted in a finite or infinite ground plane. The solutions obtainable with the procedure are particularly useful for subsequent numerical computation of an antenna's radiation pattern performance, when introduced into a different structural environment. Several example solutions are presented to demonstrate the procedure and to point out specific techniques found useful in its implementation. Author (GRA)

N79-24218# Orincon Corp., La Jolla, Calif.
NEW FIDELITY CRITERIA FOR DISCRETE-TIME SOURCE ENCODING Final Report, Jan. - Oct. 1978
J. T. Rickard and R. R. Kolesar 1 Oct. 1978 37 p refs
(Contract N66001-78-C-0051)
(AD-A065802; NOSC-TR-254) Avail: NTIS HC A03/MF A01 CSCL 09/4

A probabilistic approach to the source encoding problem requires the specification of a fidelity criterion which measures the degradation of the source output produced by the encoding transformation. Historically, the fidelity criteria generated by difference-type distortion measures have received by far the widest acceptance, due in part to their analytical tractability. This paper introduces two new fidelity criteria for discrete-time sources. These are designated as the mean incoherence(MIC) and the mean log-coherence (MLC). Both criteria are functionals of the magnitude-squared coherence between the source output and its reproduction, and thus do not admit a recognizable time-domain distortion measure representation. Interesting features of these fidelity criteria are indicated, and comparisons are made with the classical mean-squared error (MSE) fidelity criterion. The rate-distortion functions for a stationary Gaussian source subject to constraints on either the MIC or MLC are derived, and the corresponding optimum encoder behavior is described. Finally, the applications where these new fidelity criteria may be advantageous over the MSE criterion are discussed. Author (GRA)

N79-24219# Naval Surface Weapons Center, White Oak, Md.
SEATRACKS: A 35 GHz MONOPULSE TRACKING RADAR Interim Report
L. M. Black, J. W. McCorkle, G. E. Layman, and N. DeMinco 10 Mar. 1978 43 p refs
(ZF61112001)
(AD-A065933; NSWC/WOL/TR-78-30) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report describes the development and theoretical analysis of a 35 GHz Monopulse Tracking Radar. Some notes on the rationale behind the program are followed by an explanation of monopulse and the specifications and block diagrams of the SEATRACKS system. The operation of the radar is described by giving the details of each subsystem (i.e., receiver, transmitter, range tracker, etc.). The system performance analysis is described. GRA

N79-24220# Ohio State Univ., Columbus. Electroscience Lab.
OPTIMUM FREQUENCIES FOR AIRCRAFT CLASSIFICATION
Lin Heng-Cheng and A. A. Ksienski Jan. 1979 124 p refs
(Grant AF-AFOSR-2611-74; AF Proj. 2304)
(AD-A065697; ESL-(78)3815-6; AFOSR-79-0255TR) Avail: NTIS HC A06/MF A01 CSCL 17/9

The results are presented of a search for optimum frequencies to classify eight aircraft types by means of their radar returns. The performance, in terms of misclassification probabilities as a function of SNR, is presented for different feature sets ranging from amplitude returns for a single frequency through amplitude and phase for various frequency pairs. Author (GRA)

N79-24221# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TARGET DETECTION WITH A DIRECT-RECEPTION OPTICAL RADAR Project Report
Jeffrey H. Shapiro 16 Nov. 1978 65 p refs
(Contract F19628-78-C-0002)
(AD-A065627; TST-27; ESD-TR-78-290) Avail: NTIS HC A04/MF A01 CSCL 17/9

A theoretical study of the use of a direct reception Nd: YAG laser radar for target detection is reported. This work builds from a mathematical system model which incorporates the statistical effects of propagation through atmospheric turbulence, target speckle and glint, and receiver noise; both photomultiplier and avalanche photodiode receivers are considered. Results are presented for the receiver signal-to-noise ratio which show, explicitly, the deleterious effects of atmospheric scintillation on system performance. The structure and performance of the optimum likelihood-ratio processor for single-pulse target detection are analyzed. Author (GRA)

N79-24222# Auburn Univ., Ala. Engineering Experiment Station.
AUTOMATIC TARGET HAND-OFF FOR NON-COMPATIBLE IMAGING SYSTEMS Final Technical Report, 20 Jul. 1977 - 15 Sep. 1978
J. S. Boland, L. J. Pinson, and E. G. Peters 15 Sep. 1978 116 p refs
(Contract DAAK40-77-C-0156)
(AD-A065525) Avail: NTIS HC A06/MF A01 CSCL 17/8

The problem of automatic hand-off of a target from a precision pointing and tracking system (PTS) to an imaging missile seeker using non-compatible imaging systems is considered in this report. The approach taken is to develop preprocessing algorithms which transform the input video signals to a compatible format for input to a binary correlation system. The types of imaging systems considered are a high resolution day TV PTS for target acquisition and a low resolution Infra-Red Imaging Seeker (IRIS) for the missile system. The approach taken is to study the effects on the correlation system of a number of preprocessing algorithms so that trade-offs of each can be presented. The results of implementing the preprocessing algorithms in a correlation system simulation are given and explained. The effects of differing sensor characteristics on the correlation function and the acceptance/rejection threshold are given. A preprocessing

algorithm using edge detection is chosen and the advantages and disadvantages are listed. Author (GRA)

N79-24223# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
SIGNAL PROCESSING WITH SAW DEVICES
L. B. Milstein, D. R. Arsenault, and P. Das 15 Oct. 1978 7 p refs
(Grant DAAG29-77-G-0205)
(AD-A065520; MA-ARO-5; ARO-15004.6-EL) Avail: NTIS HC A02/MF A01 CSCL 17/2

The use of surface acoustic wave devices to perform real time Fourier transformation for time-limited signals is well known. In this paper a detailed analysis justifying the implementation most typically employed will be presented, as the description of a scheme which extends the above technique by allowing the transformation of a long sequence of contiguous random data. This latter situation, of course, is that normally encountered in a digital communication system. Author (GRA)

N79-24224# SRI International Corp., Menlo Park, Calif.
COMPARATIVE EQUATORIAL SCINTILLATION MORPHOLOGY: AMERICAN AND PACIFIC SECTORS Topical Report no. 3, 1 Jun. 1977 - 30 Jun. 1978
Robert C. Livingston 30 Jun. 1978 55 p refs
(Contract DNA001-77-C-0220)
(AD-A066094; AD-E300469; DNA-4644T) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report examines the severity of radio-wave amplitude scintillation measured at two stations near the equator, but far apart in longitude: Kwajalein Atoll in the Marshall Islands, and Ancon, Peru. The data used are observations of the Wideband satellite signal intensity at VHF, UHF, and L-band frequencies. These are presented in terms of the cumulative distribution of S4 index, which provides a precise measure of the level of disturbance that can be readily related to the distribution of signal intensity. The seasonal behavior of the scintillation at the two stations is similar, with each showing a broad 8-to-9-month disturbed season centered about local summer. There is little difference in the occurrence or severity of gigahertz scintillation at the two stations. However, there is a systematic difference between the frequency dependences of the scintillation. The latitude distributions of scintillation show the expected enhancement from propagation geometry at low elevation angles. When these effects are removed to obtain irregularity source strength, the irregularity source regions are found at some distance from the magnetic equator. It is suggested that the weak-to-moderate scintillation that dominates the observations arises from interactions between neutral waves and ionization in the F region.GRA

N79-24225# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ROUTING TO MINIMIZE THE MAXIMUM CONGESTION IN A COMMUNICATION NETWORK Ph.D. Thesis
Fransisco DeAsisRos Peran Feb. 1979 335 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A066110; LIDS-TH-885) Avail: NTIS HC A15/MF A01 CSCL 17/2

Some new results in the area of routing algorithms for communication networks are presented. The aim has been to take as much advantage as possible of the inherent structure of the routing problem, as given by the graph supporting the network. It seems reasonable to believe that new insights in topological design can be developed as one gains new understanding of how performance varies with routing policy when topology is held fixed. For the purpose of making the topological structure of the network to explicitly appear in the routing policy, an optimization criteria that divides into a hierarchy of linear programs with a natural hierarchical partition of the network, has been chosen. The power of the criteria lies in the fact that, given the network state, it identifies the 'worst' congestion problem and alleviates it with maximum resources. Furthermore the linear programming formulation allows one to express all results in terms of graph related matrices. This fact contributes, not only to reduce the amount of computation needed for finding, and dynamic tracking, the optimal solution, but it also provides with properties and simplifications that can be used for gaining a better understanding of the routing policy, or optimal routing policies in general if one assumes that optimal policies do not differ much from one another. GRA

N79-24226# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
INVESTIGATION OF ELECTROMAGNETIC COUPLING THROUGH SINGLE OR MULTIPLE APERTURES INTO CYLINDRICAL STRUCTURES Final Report, 1 Dec. 1977 - 28 Feb. 1979
S. W. Lee and R. Mittra Feb. 1979 127 p refs
(Contract N00014-75-C-0293)
(AD-A065585; UIEM-79-3; UILU-ENG-79-2542) Avail: NTIS HC A07/MF A01 CSCL 20/14

Two topics of interest in the study of high-frequency radiation and electromagnetic compatibility are described in this report. The first problem considered is that of penetration of an incident electromagnetic wave through a slot on a cylinder. This problem is solved via an application of the method of moments. Next considered was the problem of source radiation from a slot on the surface of a large cylinder using ray techniques and the spectral domain approach. New formulas are presented for the radiated fields and a comparison with the conventional GTD results are included. Author (GRA)

N79-24227# Mission Research Corp., Santa Barbara, Calif.
COMPARISON OF SIGNAL SCINTILLATION MODELS Progress Report, Feb. - Jun. 1978
Richard C. Scott and Dennis L. Knepp Jul. 1978 48 p refs
(Contract DNA001-77-C-0096)
(AD-A066102; AD-E300460; MRC-R-406) Avail: NTIS HC A03/MF A01 CSCL 17/2

Scintillating signals taken from the DNA Wideband satellite experiment are used as direct input to a digital simulation of a phase-shift keyed (PSK) demodulator. The resulting demodulator performance is compared to that obtained with input signals generated according to a two-component (log-normal plus joint Gaussian) model. A second comparison is made with input signals generated by a multiple phase screen propagation simulation. Results are used to assess the suitability of the models for simulation of satellite communication systems in disturbed environments. Author (GRA)

N79-24228# Nebraska Univ., Lincoln. Dept. of Electrical Engineering.
ELECTROMAGNETIC FIELDS IN NONUNIFORM MULTILAYERED STRUCTURES WITH ENGINEERING APPLICATIONS Final Report, 27 Nov. 1974 - 26 Nov. 1976
Ezekiel Bahar Jan. 1979 14 p Sponsored in part by NSF
(Contract DAHC04-75-G-0076)
(AD-A065515; ARO-12247.3-EL) Avail: NTIS HC A02/MF A01 CSCL 20/14

The recent impetus to produce rigorous solutions to more realistic models of pertinent propagation problems, over a wide frequency range, has generated the need to derive full wave solutions to problems of radio wave propagation in dispersive, inhomogeneous, anisotropic and dissipative media with irregular boundaries. The considerable growth in civil and military interest in the development of more reliable systems for communication, detection, navigation and positioning, the potential for developing radio wave methods for remote sensing and the need to develop secure hardened communication systems have contributed much to this renewed interest. These developments have been paralleled by remarkable advances that have been made in the availability of high powered, very low frequency electromagnetic sources as well as the availability of transmitters operating at optical frequencies. The ready access to large, versatile digital computers has made it possible to employ the rigorous full wave approach to obtain numerical solutions to a wide class of important problems which have hitherto been either ignored or over-idealized in order to reduce them to tractable problems. The results of these investigations have been presented in 50 technical articles which include published manuscripts, computer program papers and invited and contributed papers at international conferences. GRA

N79-24229# Ohio State Univ., Columbus. Electroscience Lab.
AN ASYMPTOTIC RESULT FOR THE SCATTERING OF A

PLANE WAVE BY A SMOOTH CONVEX CYLINDER
P. H. Pathak Mar. 1978 41 p refs
(Contract N62269-76-C-0554)
(AD-A065588; ESL-(78)4583-3; NADC-79043-30) Avail: NTIS HC A03/MF A01 CSCL 20/14

An approximate asymptotic high frequency result which is convenient for engineering applications is obtained for the field scattered by a smooth, perfectly-conducting convex cylinder when it is illuminated by a plane wave. This result is uniform in the sense that it remains valid within the transition regions adjacent to the shadow boundaries where the pure ray optic (or GTD) solution fails, and it automatically reduces to the ray optic solution exterior to the transition regions where the latter solution becomes valid. Furthermore, this result is expressed in the convenient format of the GTD, and it employs the same ray paths as in the GTD solution. This uniform result is not valid in the close neighborhood of the cylinder; hence, a separate asymptotic result is presented for this special case in a form which is also convenient for applications. The asymptotic results presented here are useful for predicting the patterns of antennas radiating in the presence of convex, conducting cylindrical structures. Author (GRA)

N79-24230# Pacific-Sierra Research Corp., Santa Monica, Calif.
AN INTEGRAL-EQUATION APPROACH TO ELF PROPAGATION IN A NON-STRATIFIED EARTH-IONOSPHERE WAVEGUIDE Final Technical Report
E. C. Field Feb. 1979 43 p refs
(Contract N00014-78-C-0336)
(AD-A066097; PSR-904) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report develops and applies a practical method for analyzing long-wave propagation under conditions where the properties of the earth-ionosphere waveguide change markedly over lateral distances comparable to a wavelength or Fresnel zone. Full-wave solutions are used to describe both the vertical and horizontal dependences of the fields, but certain compromises are made to achieve tractability. The method is thus characterized as quasi-full-wave. Its main limitation is that the equation describing the vertical dependence is assumed to nearly decouple from the equation governing the lateral dependence. The method is valid at any frequency for which waveguide modes describe terrestrial propagation. Nonetheless, its practical utility is probably limited to ELF because the lateral properties of the earth-ionosphere waveguide are usually gradual enough to permit use of the WKB approximation at higher frequencies. To facilitate numerical solution, the lateral equation is transformed into an integral equation that accounts for most full-wave properties, including diffraction around a localized disturbance and reflection from lateral gradients. Numerical solutions based on model disturbances having lateral gradients in the direction of propagation reveal a standing wave pattern in front of the disturbance. GRA

N79-24231# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF ANTENNA ARRAYS ON BROADBAND SIGNALS M.S. Thesis
Edward Raska, Jr. Sep. 1978 142 p refs
(AD-A064679; AFIT/GE/FE/78-14) Avail: NTIS HC A07/MF A01 CSCL 09/5

This paper develops a complex, baseband model for an adaptive array. The array is assumed to have N isotropic elements. Only two aspects of arrays are modeled: spatial propagation delays and the weighting coefficients. The array model is used to determine the effects of arrays on wideband signals. The most important finding is that the output of the array consists of the input signal and its time derivatives. Each of these signal components is multiplied by a complex number that is a function of the array and signal parameters. Properties of these complex numbers are investigated. A four element linear array is used as a specific example to illustrate these properties. Two models of the weighting coefficients are analyzed to develope information about 'adaptive' effects. These models are used to show how the array output is degraded by changing coefficients.
Author (GRA)

N79-24232# SRI International Corp., Menlo Park, Calif.
NAP-OF-THE-EARTH COMMUNICATION PROGRAM FOR US ARMY HELICOPTERS Final Report, 1 Mar. 1976 - 31 Mar. 1978
Bruce C. Tupper and George H. Hagn Jun. 1978 331 p refs
(Contract DAAB07-76-C-0868; SRI Proj. 4979)
(AD-A063089; USAAVRADCOM-76-0868-F) Avail: NTIS HC A15/MF A01 CSCL 17/2

The communication problem, requirements, and solutions for helicopters flying nap-of-the-earth (NOE) in the modern battlefield are given. A model for predictions of communication ranges in irregular terrain (terrain, noise environment and radio system parameters as variables) was developed. Model inputs are median basic transmission loss, man-made, atmospheric, and galactic noise, candidate radio system parameters (Transmitter ERP and required SNR at receiver), and the standard deviations of these parameters. The model output is the probability of successful communication at a given range in irregular terrain. The model was used in the European SCORES scenario to predict communication and mission effectiveness in the Fulda region for candidate radio systems. Limited model validation data are given. Quantitative test results for the TCATA FM-320 NOE communication test are given and discussed. These tests compared the AN/ARC-117 Baseline radio with other radio candidates 40-W VHF, Retransmission, and HF/SSB. In addition, quantitative results are given for VHF/FM, HF/SSB, and satellite NOE systems tests. J.M.S.

N79-24233# Naval Research Lab., Washington, D. C.
A REVIEW OF RECENT RESULTS ON SPREAD F THEORY Interim Report
S. L. Ossakow 9 Jan. 1979 53 p refs
(AD-A066175; AD-E000273; NRL-MR-3909) Avail: NTIS HC A04/MF A01 CSCL 04/1

Although ionospheric Spread F was discovered four decades ago, only in the past few years has significant progress been made in the theoretical explanation of such phenomena. In particular, considerable effort has been expended to explain equatorial Spread F and the attendant satellite signal propagation scintillation phenomena. The present review dwells mainly in this low latitude area. The various linear plasma instabilities thought to initiate equatorial Spread F are discussed. Recent theoretical and numerical simulation studies of the nonlinear evolution of the collisional Rayleigh-Taylor instability in equatorial Spread F is reviewed. Analytical studies of rising equatorial Spread F bubbles in the collisional and collisionless Rayleigh-Taylor regime are discussed, as well as the nonlinear saturation of instabilities in these two regimes. Current theories on very small scale size irregularities observed by radar backscatter during equatorial Spread F and their relation to the larger wavelength scintillation causing irregularities are discussed. Application of turbulent theory to equatorial Spread F phenomena is reviewed and remaining problems to be dealt with at equatorial latitudes are summarized. GRA

N79-24234# Illinois Univ. at Urbana-Champaign, Urbana.
AN INVESTIGATION ON CHARACTERIZING MUTUAL COUPLING BETWEEN TOW ANTENNA SLOTS ON A CONE Final Report, 16 Nov. 1977 - 15 Jan. 1979
S. W. Lee, N. Mittra, J. Boersma, and E. Yung Jan. 1979 196 p refs
(Contract N00019-78-C-0064)
(AD-A066330; UIEM-79-2; UILU-ENG-79-2541) Avail: NTIS HC A09/MF A01 CSCL 09/5

This is the final report for Naval Air Systems Command Contract on the mutual coupling effect in a conformal array. It contains a brief administrative summary plus three attachments which give the technical details. Author (GRA)

N79-24235# Naval Research Lab., Washington, D. C.
FEASIBILITY STUDY OF FERRITE USE AT mm WAVES Interim Report
C. Vittoria 26 Jan. 1979 30 p refs
(ZF54581001)
(AD-A066178; AD-E000272; NRL-MR-3919) Avail: NTIS HC A03/MF A01 CSCL 09/3

A survey was conducted in order to establish the usefulness of ferrites at millimeter wave frequencies. We expect hexagonal ferrites to be operational up to approximately 500 GHz for non-reciprocal device applications. The limiting factor of these

types of ferrites at millimeter wave frequencies may possibly be that the dielectric propagation loss is too high. Beyond 500 GHz antiferromagnetic materials may have to be explored for possible uses. Author (GRA)

N79-24236# California Univ., Davis. Signal and Image Processing Lab.

EXTRAPOLATION AND SPECTRAL ESTIMATION TECHNIQUES FOR DISCRETE TIME SIGNALS

Anil K. Jain and Surendra Ranganath Nov. 1978 105 p refs Prepared in cooperation with State Univ. of New York at Buffalo

(Contracts DAAG29-78-A-0206; F30602-75-C-0122)

(AD-A066139; SIPL-78-1; ARO-16222.1-EL) Avail: NTIS HC A06/MF A01 CSCL 09/3

This report considers spectral estimation and extrapolation techniques for discrete time, band limited signals which are observable only for a finite duration. The objective is to determine the spectrum (or power spectrum) of these signals. It is shown that the estimated spectrum can be improved considerably (over a periodogram of Maximum entropy spectrum) by first extrapolating the given observations beyond the observation interval. Also, we consider the problem of extrapolation of signal in the presence of noise or other interfering signals. Several new results and algorithms are presented. Author (GRA)

N79-24237# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

COMMUNICATION COMPLEXITY OF DISTRIBUTED SHORTEST PATH ALGORITHMS M.S. Thesis

Daniel U. Friedman Feb. 1979 103 p refs

(Contract N00014-75-C-1183; Grant NSF ENG-77-19971; ARPA Order 3045)

(AD-A066152; LIDS-TH-886) Avail: NTIS HC A06/MF A01 CSCL 09/2

One routing strategy frequently used in computer networks assigns traffic dependent distances to the links of the network and then increases the traffic flow on shortest paths. If a central facility monitors all network traffic, classical algorithms can be readily employed to compute shortest paths. If traffic is only locally monitored, we wish to have distributed procedures in which the nodes begin with only local information and compute shortest paths by communicating with one another. We present several such distributed shortest path algorithms and analyze their communication cost. Since the transmission of control information required for network operation reduces the bandwidth available to users, we concentrate on finding algorithms that use a minimum of information exchange. Author (GRA)

N79-24238# Lincoln Lab., Mass. Inst. of Tech., Lexington.

THE MONOPULSE PERFORMANCE OF AN OPTICAL HETERODYNE DETECTOR WITH VARYING LO DISTRIBUTIONS

Richard J. Sasiela Dec. 1978 63 p refs

(Contract F19628-78-C-0002; ARPA Order 600)

(AD-A066253; TN-1978-29; ESD-TR-78-376) Avail: NTIS HC A04/MF A01 CSCL 17/8

Calculations are performed to determine the monopulse characteristics, the signal-to-noise ratio, efficiency, and the transmit-receive pattern of an optical heterodyne detector composed of four quadrants. The variation of these quantities for a varying receive beam size on the detector, and a uniform LO, and Gaussian and Airy LO distributions of varying size are tabulated. The calculations are applied to determine the possibility of increasing the angular coverage of an optical heterodyne receiver. Author (GRA)

N79-24239# Defense Communications Engineering Center, Reston, Va.

PRIORITY LOSS SYSTEMS: UNEQUAL HOLDING TIMES

M. J. Fischer Feb. 1979 28 p refs

(AD-A066245; AD-E100187; DCEC-TN-1-79) Avail: NTIS HC A03/MF A01 CSCL 17/2

Two classes of voice calls use the same s-channel trunk group. A mathematical model is developed for the case where one class of traffic can preempt the other and the mean holding times of each class of traffic may be different. These results are then used to numerically investigate the behavior of various measures of performance for both classes of customers as well as the system in general. Author (GRA)

N79-24240# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.

MEASUREMENTS OF COHERENCE IN ELF EMISSION BETWEEN SETS OF CONJUGATE POINTS [MESURE DE LA COHERENCE DES EMISSIONS UBF ENTRE DEUX COUPLES DE POINTS CONJUGUES]

F. Glangeaud, J. L. Lacoume, R. Gendrin (Centre de Rech. en Phys. de l'Environ. Terrestre et Planetaire), S. Perraut (Centre de Rech. en Phys. de l'Environ. Terrestre et Planetaire), and C. deVilledary (Centre de Rech. en Phys. de l'Environ. Terrestre et Planetaire) 28 Jul. 1977 15 p In FRENCH; ENGLISH summary Presented at IAGA Assembly, Seattle, Aug.-Sep. 1977

(CEPHAG-37/77) Avail: NTIS HC A02/MF A01

Cross spectral density was measured between conjugate points. A network of stations forming a set of conjugate points, measured signal coherence. The results were compared two by two. The principles used and precision achieved in measurements of the coherence coefficient C(v) are described. The stationary linear relation between two ELF signals is discussed. Results show that the modulus of C(v) may be larger between signals from conjugate points than between signals from near-by stations in the same hemisphere. The precision obtained measuring the back and forth difference propagation time was 1 sec.

Author (ESA)

N79-24241# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.

SPECTRAL ANALYSIS BY MEANS OF AUTOREGRESSIVE FILTER [ANALYSE SPECTRALE PAR LE MOYEN D'UN FILTRE AUTOREGRESSIF]

C. Hanna 7 Sep. 1977 54 p refs In FRENCH

(CEPHAG-41/77) Avail: NTIS HC A04/MF A01

A nonlinear technique for estimating spectral power density was developed, based on the Burg method (1967). Included are discussions of putting the problem in model form, the Yule Walker method, the Burg method, the maximum entropy criteria, determination of the order of the filter, and calculation procedures with examples. Results show that the Burg method gives better results in the sense of being closer to the real spectral power density, having a higher resolution power as can be seen in the practical examples. It is suggested that this method be extended to two dimensions and that it be compared with other estimating methods such as maximum likelihood. Author (ESA)

N79-24242# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.

STUDY OF THE INFLUENCE OF NEGATIVE IONS ON THE INCOHERENT SCATTERING SPECTRA [ETUDE DE L'INFLUENCE DES IONS NEGATIFS SUR LE SPECTRE DE LA DIFFUSION INCOHERENTE]

W. Kofman 14 Oct. 1977 21 p refs In FRENCH

(CEPHAG-45/77) Avail: NTIS HC A02/MF A01

Scattering spectra of a plasma composed of negative ions, positive ions, and electrons was studied. The influence of negative ions was derived using the Banks and Kockarts ionosphere model. Negative ions make an important contribution to signal power coming from incoherent scattering. The power can show an increase of 10 db over the power of a spectrum which does not take into consideration the effect of negative ions. Correct interpretation of measurements from the mesophere requires taking this effect into account. Author (ESA)

N79-24243# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysique.

COMPARATIVE STUDY OF PHASE CURVES OBTAINED BY DIFFERENT METHODS FOR ESTIMATING CROSS SPECTRAL DENSITY. GEOGRAPHIC APPLICATIONS: MEASURE OF PHASE SHIFT AND DELAY OF PC 1 SIGNALS [ETUDE COMPARATIVE DES COURBES DE PHASE OBTENUES PAR DIFFERENTES METHODES D'ESTIMATION DE LA (LC4) DSPC. APPLICATIONS GEOGRAPHIQUES: MEASURE DE DEPHASAGE ET DE RETARD SUR SIGNAUX PC 1]

H. Fargetton 15 Feb. 1978 50 p refs In FRENCH

(CEPHAG-4/78) Avail: NTIS HC A03/MF A01

A theoretical comparison of several methods was made using

locally white random signal delay measurements obtained by linear regression of phase curves at the relevant frequency zone. The precision of the measurement is determined as a function of delay and the coherence coefficient which plays the role of a signal to noise ratio. Application to geophysical PC 1 gives measurements with a precision very similar to calculations. The stationary hypotheses for the propagation media and PC 1 as a locally white random process is verified, excluding the influence of the PC 1 structure behind the wavetrain. Author (ESA)

N79-24244# Montpellier Univ. (France). Lab. de Physique Mathematique.
SPECTRAL AND SCATTERING INVERSE PROBLEMS
P. C. Sabatier Apr. 1978 56 p refs
(PM/78/4) Avail: NTIS HC A04/MF A01

The reconstruction of a differential operator from discrete spectra is reduced to its reconstruction from an S-matrix. This method makes it possible to solve the singular Sturm-Liouville problems which determine certain modes of a sphere. Results show that information on modes and scattering can be taken into account together. They are applied to the earth inverse problem and partial answers are given to a well-known conjecture. Finally, the relevance of the JWKB approximation to this kind of problem is succinctly discussed. Author (ESA)

N79-24245# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Forsch. Inst. fuer Angew. Naturwiss. E. V.
CONSIDERATIONS CONCERNING DETECTION OF NONCOOPERATIVE ILLUMINATED TARGETS
G. Retzer Jan. 1978 50 p refs In GERMAN; ENGLISH summary
(Rept-2-78) Avail: NTIS HC A03/MF A01

The possibility of detection of noncooperative illuminated targets by a passive radar system is examined. Under the assumption that both target and receiver are within the illuminated volume, the principle of detection is explained first and typical characteristics of such a system are pointed out. Investigations applying optimal filter theory lead to different receiver structures as yet providing no usable solution under real world conditions. Hence, detection of noncooperative illuminated targets is not feasible in praxis if both receiver and target are within the illuminated volume. The possibility of detection under different illuminator-receiver configurations is briefly discussed.
Author (ESA)

N79-24246# Mitre Corp., McLean, Va. METREK Div.
THE IMPACT OF TELECOMMUNICATION ON TRANSPORTATION DEMAND THROUGH THE YEAR 2000
Nov. 1978 163 p refs Prepared for Natl. Transportation Policy Study Comm., Washington, D. C.
(PB-290833/3; NTPSC/SR-78/03) Avail: NTIS HC A08/MF A01 CSCL 17B

The interactions of transportation and telecommunication as they exist today and in the future are analyzed, especially as regards the effects of telecommunication on transportation demand. Four major telecommunication services voice, video, data and interactive cable television are included. Estimates of their substitutability for transportation service are given. GRA

N79-24247# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
MEASUREMENTS OF LF AND MF RADIO PROPAGATION OVER IRREGULAR, INHOMOGENEOUS TERRAIN
W. A. Kissick, E. J. Haakinson, and G. H. Stonehocker Nov. 1978 181 p refs
(PB-291732/6; NTIA/Report-78/12) Avail: NTIS HC A09/MF A01 CSCL 20N

Measurements of radio propagation path loss and local ground conductivity were made over four paths in the 100 to 2000 kHz band. The paths were of lengths up to 50 km and were chosen to represent both extreme and typical topography and conductivity conditions to the U.S. The measurements were made near Canyonlands National Park in Utah, at Highland Range and Dry Lake Valley in Nevada, over the Santa Rita Range in Arizona, and across San Francisco Bay in California. The measurement results with propagation predictions made by a computer program which uses the path profile, ground conductivity and frequency as prediction parameters are presented. GRA

N79-24248# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
SPECTRUM EFFICIENCY FOR MULTIPLE INDEPENDENT SPREAD-SPECTRUM LAND MOBILE RADIO SYSTEMS
Leslie A. Berry and E. J. Haakinson Nov. 1978 69 p refs Sponsored in part by FCC
(PB-291539/5; NTIA/Report-78/11) Avail: NTIS HC A04/MF A01 CSCL 17B

The use of spread-spectrum modulation in a common type of land-mobile radio service is studied. The radio service contains many networks operated independently, similar to the business land-mobile radio service. A congested urban environment is assumed. If a band is allocated exclusively to spread-spectrum modulation for such a service, base stations and mobiles must operate on different channels, and all base station antennas must be located within a relatively small area. In this case, the worst interference is in the mobile-to-base channel. An explicit formulation of the far-near problem and a powerful computer calculation both show that in such a service spread-spectrum modulation is less spectrum efficient than conventional FM modulation. In fact, the spectrum efficiency of the spread-spectrum systems is inversely proportional to the cube root of the processing gain. However, overlaying a spread-spectrum system on conventional bands shows some promise. GRA

N79-24249# General Accounting Office, Washington, D. C. Community and Economic Development Div.
DEVELOPING A DOMESTIC COMMON CARRIER TELECOMMUNICATIONS POLICY: WHAT ARE THE ISSUES
24 Jan. 1979 59 p
(PB-290787/1; CED-79-18) Avail: NTIS HC A04/MF A01 CSCL 17B

The issues studied by the Congress on the domestic carrier policy are presented. Included are: (1) what policy goals should the United States pursue; (2) what industry structure should supply common carrier services; and (3) can the present regulating methods be improved. GRA

N79-24250# Federal Communications Commission, Washington, D. C. Research and Standards Div.
INVESTIGATION OF METHODS FOR CONVERTING THE FCC GROUND WAVE FIELD INTENSITY CURVES TO THE METRIC SYSTEM
John H. McMahon Jan. 1979 41 p refs
(PB-290930/7; FCC/OCE/RS-79/01) Avail: NTIS HC A03/MF A01 CSCL 17B

Methods of calculating ground wave field intensities in the Standard Broadcast band are described. This examination of the literature was to provide a background for developing a computer program which would revise the present FCC Ground Field Intensity Curves to the metric system. No method of calculation was found which exactly duplicated field intensities given in the existing FCC curves. Figures comparing field intensities predicted by several methods and by existing FCC curves are provided. Also included is a FORTRAN listing of the computer programs developed during the study for calculation of field intensities.
GRA

N79-24251# Federal Communications Commission, Washington, D. C. Spectrum Allocations Div.
AN AUTOMATED RETRIEVAL SYSTEM FOR FREQUENCY ALLOCATION INFORMATION
Joseph V. Cesaitis Jan. 1979 70 p ref
(PB-291600/5; FCC/OCE/SAD-79/01) Avail: NTIS HC A04/MF A01 CSCL 17B

The procedure for retrieving frequency allocation information under the control of a computer progra u is described. There are three separate data bases containing information from three tables of frequency allocations which may be queried through this retrieval system. The sources for these three data bases are the Federal Communications Commission's (FCC) Rules and Regulations, Volume II, Section 2.106; the International Telecommunications Union (ITU) Radio Regulations, Article 5 (region 2 only); and the Eighth Notice of Inquiry, Appendix 2, Docket

20271 for the 1979 World Administrative Radio Conference (WARC) (Region 2 only). GRA

N79-24252# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMMUNICATIONS TECHNOLOGY FORECAST
Ira Richer, Philip A. Bernstein, Alexander A. McKenzie, Jeffrey Mayersohn, Theodore H. Myer, Peter Sevick, Lawrence D. Sher, Marianne Steiner, and Michael A. Wingfield Jan. 1979 349 p refs
(Contract NO1-LM-8-4726)
(PB-292697/0; BBN-4037; LHNCBC-79/03) Avail: NTIS HC A15/MF A01 CSCL 17B

The forecast extends through 1985 and covers important topics in general areas of data communications and in some other communications-based technologies. The emphasis was on available and emerging technologies, rather than on specific end-user requirements, and the treatment of each subject balances the technical potential of new technologies against nontechnical considerations. Topics include network architectures; transmission media; communication protocols; internetworking, security; software; microprocessors, minicomputers and terminals; digital transmission of analog signals; facsimile and OCR, audiovisual techniques; teleconferencing; and distributed data base systems. GRA

N79-24253# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
ANTENNAS AND THE ASSOCIATED TIME DOMAIN RANGE FOR THE MEASUREMENT OF IMPULSIVE FIELDS
Robert A. Lawton and Arthur R. Ondrejka Nov. 1978 69 p refs
(PB-291733/4; NBS-TN-1008) Avail: NTIS HC A04/MF A01 CSCL 14B

The construction and evaluation of a TEM horn antenna designed at NBS to be used as a transfer standard to generate and measure impulsive electromagnetic fields is reported. The different electrical field generation and measurement techniques were analyzed to determine the major sources of error and establish a standard of impulsive field strength having a well establish statement of accuracy. The evaluation of this horn was done in two independent ways, by placing the horn in the field of a conical transmission line, and by a three antenna intercomparison. The two methods were found to agree within + or - 3 dB over the range of 0.6 to 5 GHz. Part of this disagreement is due to the assumption of far field conditions, and an experimental technique is described which determines the frequency range over which this assumption is valid. GRA

N79-24738*# Naval Research Lab., Washington, D. C.
SHIELDING OF LONGITUDINAL MAGNETIC FIELDS WITH THIN, CLOSELY, SPACED CONCENTRIC CYLINDRICAL SHELLS WITH APPLICATIONS TO ATOMIC CLOCKS
S. A. Wolf, D. U. Gubser, and J. E. Cox *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 131-146 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

N79-24746*# Defense Communications Engineering Center, Reston, Va.
OVERVIEW OF TIMING/SYNCHRONIZATION FOR DIGITAL COMMUNICATIONS
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 393-403 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

N79-24747*# NEC American, Inc., Dallas, Tex.
SURVEY OF TIMING/SYNCHRONIZATION OF OPERATING WIDEBAND DIGITAL COMMUNICATIONS NETWORKS
Ronald L. Mitchell (Electrospace Systems, Inc.) *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 405-435 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

N79-24748*# Harris Corp., Melbourne, Fla.
AN EVALUATION OF OPTIONAL TIMING/SYNCHRONIZATION FEATURES TO SUPPORT SELECTION OF AN OPTIMUM DESIGN FOR THE DCS DIGITAL COMMUNICATION NETWORK
D. B. Bradley, J. B. Cain, III, and M. W. Williard *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 437-461 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

N79-24749*# Harris Corp., Melbourne, Fla.
EFFECT OF VARIOUS FEATURES ON THE LIFE CYCLE COST OF THE TIMING/SYNCHRONIZATION SUBSYSTEM OF THE DCS DIGITAL COMMUNICATIONS NETWORK
D. B. Kimsey *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 463-489 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-24254* National Aeronautics and Space Administration. Pasadena Office, Calif.
MODULE FAILURE ISOLATION CIRCUIT FOR PARALLELED INVERTERS Patent
Satoshi Nagano, inventor (to NASA) (JPL) Issued 17 Apr. 1979 6 p Filed 9 Feb. 1978 Supersedes N78-22299 (16 - 13, p 1694) Sponsored by NASA
(NASA-Case-NPO-14000-1; US-Patent-4,150,425; US-Patent-Appl-SN-876431; US-Patent-Class-363-56; US-Patent-Class-307-82; US-Patent-Class-363-71; US-Patent-Class-363-97) Avail: US Patent and Trademark Office CSCL 09C

A module failure isolation circuit is described which senses and averages the collector current of each paralled inverter power transistor and compares the collector current of each power transistor the average collector current of all power transistors to determine when the sensed collector current of a power transistor in any one inverter falls below a predetermined ratio of the average collector current. The module associated with any transistor that fails to maintain a current level above the predetermined radio of the average collector current is then shut off. A separate circuit detects when there is no load, or a light load, to inhibit operation of the isolation circuit during no load or light load conditions.

Official Gazette of the U.S. Patent and Trademark Office

N79-24255 Rutgers - The State Univ., New Brunswick, N. J.
POLYNOMIAL REPRESENTATIONS AND AN ITERATIVE PROCEDURE FOR FILTER REALIZATION Ph.D. Thesis
Frank Chih-Shing Liu 1978 237 p
Avail: Univ. Microfilms Order No. 7910408

A polynomial representation using a set of generalized Lagrange polynomials for a basis is considered as an alternative to the natural representation. This representation (block) is employed for solving the realization problem of electrical wave filter synthesis. The polynomial operations for filter realization are described as well as vector space algorithms. The accuracy obtained from this representation is discussed. Advantages in both accuracy and simplicity of the new algorithms are noted.

Dissert. Abstr.

N79-24256 West Virginia Univ., Morgantown.
THE EFFECT OF CARBON MONOXIDE AND METHANE ON THE RESISTANCE OF TIN OXIDE THIN FILMS

Ph.D. Thesis
Richard William Young 1978 138 p
Avail: Univ. Microfilms Order No. 7910916

The resistance changes obtained from experiments involving the exposure of tin oxide thin films to low concentrations of carbon monoxide and methane mixed in air are described. A review of four film fabrication techniques is described along with a discussion of the known problems associated with each method. A discussion of the major points of the boundary layer theory of chemisorption and Wolkenstein's theory of chemisorption are included. The test samples, the testing procedure, and lists of the experimental apparatus needed to conduct the tests are given and described. A discussion of the experimental results is included which considers the physical reasons for the observed responses and presents a statistical evaluation of the data. Dissert. Abstr.

N79-24257* National Aeronautics and Space Administration. Pasadena Office, Calif.
CIRCUIT FOR AUTOMATIC LOAD SHARING IN PARALLEL CONVERTER MODULES Patent
Satoshi Nagano, inventor (to NASA) (JPL) Issued 10 Apr. 1979 5 p Filed 15 Sep. 1977 Supersedes N77-32402 (15 - 23, p 3071) Sponsored by NASA
(NASA-Case-NPO-14056-1; US-Patent-4,149,233; US-Patent-Appl-SN-833637; US-Patent-Class-363-71; US-Patent-Class-363-134; US-Patent-Class-363-95) Avail: US Patent and Trademark Office CSCL 09C

A nondissipative circuit for automatic load sharing in parallel converter modules having push-pull power transistors is presented. Each transistor has a separate current-sensing transformer and an impedance-adjusting transformer in series with its collector. The impedance-adjusting transformer functions as a current-controlled variable impedance that is responsive to the difference between the peak collector current of the transistor and the average peak current of all collector currents of power transistors in all modules, thereby to control the collector currents of all power transistors with reference to the average peak collector current.

Official Gazette of the U.S. Patent and Trademark Office

N79-24258*# Motorola, Inc., Phoenix, Ariz. Semidonductor Products Div.
TRANSISTOR SCREENING EVALUATION SJ6708H Final Report, Jul. 1976 - Nov. 1978
Jerry L. Barton Nov. 1978 158 p
(Contract NAS8-32087)
(NASA-CR-161234) Avail: NTIS HC A08/MF A01 CSCL 09A

A manufacturer was contracted to screen 125 transistors capable of withstanding the high level inductive voltages obtained when switching inductive loads. Planned differences included a change in die bonding to comply with NASA's desire for hard solder die attachment which further necessitated a change in package to conform to the required die mounting system. Evaluation of the electrical performance and recommended changes were made during the preliminary build phase of the program. The following sections are outlined: (1) narrative outline; (2) customer data summary and X-ray reports; (3) device specification; (4) failure analysis reports; (5) test facilities list; and (6) test measurement data. G.Y.

N79-24259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE DISTRIBUTION AUTOMATION AND CONTROL WORKING GROUP. VOLUME 1: EXECUTIVE SUMMARY
R. Caldwell Mar. 1979 33 p refs Proc. held at Baltimore, Md., 20-22 Nov. 1978 Prepared for NASA and DOE
(Contract NAS7-100)
(NASA-CR-158642; JPL-PUB-79-35-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09C

The meeting was sponsored by the Department of Energy, Division of Electric Energy Systems. Its purpose was to bring together some members of the electric utility community so that they might reach a common understanding on: (1) key issues and uncertainties to be resolved, (2) the existing state of the art, and (3) specific requirements for further RD&D in the area of DAC. The statements and recommendations formulated by the group on various topics are presented. J.A.M.

N79-24260*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INDUCTORLESS NARROW-BAND FILTER/AMPLIFIER Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 23 Apr. 1979 20 p
(NASA-Case-GSC-12410-1; US-Patent-Appl-SN-32306) Avail: NTIS HC A02/MF A01 CSCL 09A

An inductorless tuned circuit is described which employs a pair of directly coupled transistor stages which may be operated with a signal injected into the emitter of either transistor or may be operated as an oscillator. The transistors are selected so that they will be operating near and somewhat below their transitional frequency (f sub t) typically at a frequency of about F sub t/2. In one configuration, the circuit will appear as a positive reactance in series with a negative resistance. In another embodiment, the circuit will appear as a positive reactance in series with a negative resistance in parallel with a negative reactance in series with a resistance. NASA

N79-24261*# Hughes Research Labs., Malibu, Calif.
HIGH ENERGY PROTON RADIATION DAMAGE TO (AlGa)As-G AAs SOLAR CELLS Final Report, 23 Nov. 1976 - 15 Oct. 1977
R. Loo, L. Goldhammer, S. Kamath, and R. C. Knechtli Jun. 1979 39 p refs
(Contract NAS1-14727)
(NASA-CR-3148) Avail: NTIS HC A03/MF A01 CSCL 09A

Twelve 2 + 2 sq cm (AlGa)As-GaAs solar cells were fabricated and were subjected to 15.4 and 40 MeV of proton irradiation. The results showed that the GaAs cells degrade considerably less than do conventional and developmental K7 silicon cells. The detailed characteristics of the GaAs and silicon cells, both before and after irradiation, are described. Further optimization of the GaAs cells seems feasible, and areas for future work are suggested. J.A.M.

N79-24262# Varian Associates, Beverly, Mass.
CFA DESIGN IMPROVEMENT PROGRAM. VOLUME 1: INSTRUMENTED CFA STUDIES Final Report, 1 Jul. 1975 - 31 Dec. 1977
George K. Farney 2 Jun. 1978 189 p refs
(Contract N00123-75-C-1294)
(AD-A065735) Avail: NTIS HC A09/MF A01 CSCL 09/1

This report describes the technical objectives and summarizes the accomplishments during one phase of a program aimed at improving the design techniques for emitting sole, reentrant stream crossed-field amplifiers. The program efforts in this phase covered the period from July 1, 1975, to December 31, 1977. The program was sponsored by the U.S. Navy under Contract No. N00123-75-C-1294. The contract was issued by the Naval Regional Procurement Office, Long Beach, California. The technical direction of the program was initially from the Naval Electronics Laboratory Center and later from the Naval Ocean System Center, both of San Diego, California. The total program was divided essentially into two time-phased portions. This first portion consisted of a combined theoretical and experimental investigation aimed at improving understanding of the internal workings of these tubes. From this effort new design concepts have emerged that should lead to devices of improved performance. The second portion of the program to follow will consist of attempts to demonstrate the validity of the new concepts by incorporating these features into experimental vehicles for test and evaluation. GRA

N79-24263# Varian Associates, Beverly, Mass.
CFA DESIGN IMPROVEMENT PROGRAM. VOLUME 2: COMPUTER MODELING STUDIES Final Report
Hunter L. McDowell 2 Jun. 1978 326 p refs
(Contract N00123-75-C-1294)
(AD-A065736) Avail: NTIS HC A15/MF A01 CSCL 09/1

Contents: Description of the Computer Model, Correlation of Computer Model and Instrumented CFA, Computer Modeling Studies of CFA Interaction, and Approaches to CFA Design Based on the Computer Modeling Studies. GRA

N79-24264# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

THE POTENTIAL RECOVERY OF POROUS GRAPHITE FLUORIDE ELECTRODES AFTER TERMINATION OF THE LOAD CURRENT

Herbert F. Hunger and Joseph E. Ellison Jan. 1979 19 p refs

(AD-A065544; DELET-TR-79-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

The nondestructive determination of the state of discharge of primary batteries has always been of great interest to electrochemists and battery engineers. If novel electrochemical systems are introduced, with reaction mechanisms different from the classical redox reaction, the question arises whether or not such systems are more amenable to a determination of their state of discharge than the classical redox system. This was the case with the lithium/organic electrolyte/graphite fluoride system which showed a mixed potential at the cathode. Author (GRA)

N79-24265# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.

GaAs WAVEGUIDE DETECTOR ARRAY FOR AN IOC SPECTRUM ANALYZER Final Technical Report

Charles M. Wolfe 21 Dec. 1978 64 p refs

(Contract N00014-77-C-0403)

(AD-A065824) Avail: NTIS HC A04/MF A01 CSCL 14/2

Integrated optical circuits (IOC's) combining optical signal propagation with high-speed photoelectronic detection have a high potential for very fast analog or digital signal processing. A wideband, real-time spectrum analyzer using thermally grown oxides on a silicon substrate has been investigated by Anderson, Sun et al, which demonstrated the feasibility of a 3-channel time demultiplexing scheme. Data rates of 1 Mbps have been achieved using GaAs waveguide detectors, and frequency demultiplexing has also been investigated. Gallium Arsenide shows great promise as a semiconductor for use in IOC fabrication. A large variety of electronic and optical devices have been demonstrated in GaAs with the desirable attributes of high speed, low noise, and high efficiency. Lindley et al. have fabricated avalanche photodetectors with a large gain-bandwidth product (-50 GHz) and a signal-to-noise ratio of 30 dB. Stillman et al. have fabricated GaAs waveguides which operate with attenuation as low as 2 per cm at GaAs laser wavelengths. In addition, GaAs-AlGaAs double heterostructre lasers emitting at 9100 A have been integrated with high-purity GaAs waveguides. GRA

N79-24266# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.

THE MAGNETIC INDUCTION OF THE SYSTEM CONSISTING OF A COIL AND A FERROMAGNETIC SPHERICAL BODY

Samuel H. Brown and F. Edward Baker, Jr. Mar. 1979 70 p refs

(AD-A065809; DTNSRDC/PAS-78-35) Avail: NTIS HC A04/MF A01 CSCL 20/3

The magnetic induction is calculated for two configurations of a ferromagnetic spherical body surrounded by a current-carrying conductor. The first case is for an infinitesimally thin current band carrying a stationary current and surrounding a spherical shell. The second case is for a current band of finite width carrying a stationary current and surrounding a solid sphere. The ferromagnetic bodies are assumed to be linear and homogeneous. The reduction of the solution for the dipole term to that of a filamentary circular current-carrying conductor is shown in the first case when the permeability of the ferromagnetic spherical shell is allowed to approach that of free space. Author (GRA)

N79-24267# Air Force Weapons Lab., Kirtland AFB, N. Mex.

METAL-NITRIDE-OXIDE-SEMICONDUCTOR DETECTOR FOR AN IONIZING RADIATION DOSIMETER Final Report

Ronald G. Fraass Oct. 1978 46 p refs

(AF Proj. 8809)

(AD-A065995; AD-E200238; AFWL-TR-78-87) Avail: NTIS HC A03/MF A01 CSCL 18/4

This report describes the work completed by the author for his Master of Science thesis at the Air Force Institute of Technology. The topic and funds were provided by the Air Force Weapons Laboratory. A method of radiation dosimetry using a Metal-Nitride-Oxide-Semiconductor (MNOS) device as the detector was developed and partially evaluated. The MNOS devices are capable of measuring doses from 10 krds to 4 Mrds. Repeatability of observations indicates a precision of approximately 1 percent of total dose from 100 krds to Mrds (Si). Dosage in rads (rds) is obtained by reference to a calibrated source exposure rate and not to dose absorbed within the dosimeter. A Co 60 source was used for all radiation testing. Schematics are given for some of the circuits tested. Determination of dosage from the system is indirect and requires the use of a Calibration curve. Each dosimeter must be calibrated from a known source. Direct readout of dose is suggested by use of a microprocessor. Exposure to 2 x 10 to the 7th power rds did not degrade performance. Devices eventually failed due to charge migration from the large integrated circuit chip on which they were fabricated. Discrete, nonstepped gate MNOS transistors are recommended. GRA

N79-24268# General Electric Co., Pittsfield, Mass. Ordnance Systems.

ELECTRICAL CHARACTERIZATION OF LINEAR INTEGRATED CIRCUITS Final Technical Report, 15 Jul 1977 - 15 Jul. 1978

John Kulpinski, Theodore Simonsen, Richard Paskowsky, Donald Vanalstyne, and Herbert Labb Griffiss AFB, N. Y. RADC Jan. 1979 221 p refs

(Contract F30602-77-C-0153; AF Proj. 2338)

(AD-A065997; RADC-TR-78-275) Avail: NTIS HC A10/MF A01 CSCL 09/5

This report covers the work performed by General Electric, Ordnance Systems pertaining to the electrical characterization and specification of linear microcircuits. The period of report is July 1977 to July 1978. Characterization was performed on five generic classes of parts and nineteen device types. The generic classes covered are quad op amps, quad comparators, D/A converters, Bi-FET op amps and negative regulators. Software programs were developed for automatic testing on a Tektronix 3263 automatic test system. Data resulting from this effort is available under separate cover. Author (GRA)

N79-24269# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

MAGNETIC BUBBLE TRAVELING-WAVE AMPLIFIER

Louis J. Jasper, Jr. Feb. 1979 20 p refs

(AD-A065512; DELET-TR-79-4) Avail: NTIS HC A02/MF A01 CSCL 09/5

A theoretical investigation is presented that exploits the magnetic bubble phenomena for producing a new type of traveling-wave amplifier (TWA) called the Magnetic Bubble Traveling-Wave Amplifier (MBTWA). The theoretical analysis follows the method used by J. R. Pierce in determining the four (4) space charge waves on an elementary electron stream. Calculations include the determination of the propagation constants, velocity-voltage relationship, and gain parameter. Numerical estimates for velocity, voltage, and gain parameter are given. Also, some important aspects of the MBTWA are pointed out which give support to the view that this device could be applicable for high frequency operation in the millimeter wave spectrum. Author (GRA)

N79-24270# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING FOR TAPE CHIP CARRIER Quarterly Report, 1 Apr. - 30 Jun. 1978

William R. RodriguesdeMiranda Feb. 1979 83 p refs

(Contract DAAB07-77-C-0526; DA Proj. 1L7-62705-AH-94)

(AD-A065890; DELET-TR-77-0526-4) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes the work performed during the fourth quarter of a 26-month contract. The contract is aimed at establishing and demonstrating the feasibility of an automated assembly line for hybrid microcircuits using tape chip carrier technology for semiconductor devices whenever practical. The automated line will also make use of automatic substrate handling equipment to move partially assembled devices in and out of magazines. Author (GRA)

N79-24271# Stanford Univ., Calif. Edward L. Ginzton Lab.
JSEP ACHIEVEMENTS 1961-1978 (UPDATE OF 15-YEAR REPORT DATED SEPTEMBER 1976) Interim Report
Marvin Chodorow Feb. 1979 13 p refs
(Contract N00014-75-C-0632)
(AD-A065670; SUGL-2922) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report updates the information provided in the Fifteen Year Report (dated: September 1976), setting forth a number of the significant accomplishments under JSEP sponsorship in the E. L. Ginzton Laboratory (formerly the Microwave Laboratory) of Stanford University. The report summarizes, as well, the flow of some of this research from the JSEP Contract to other sponsored research contracts and grants within the university, and outside of the university- to other research and educational institutions, as well as industry. Author (GRA)

N79-24272# Varian Associates, Palo Alto, Calif. Solid State Lab.
THE III - V HETEROSTRUCTURE AVALANCHE PHOTODIODE MODULES FOR FIBER OPTIC COMMUNICATION LINKS IN THE 1.0 TO 1.3 MICROMETER SPECTRAL RANGE Interim Report, Feb. - Jul. 1978
R. E. Yeates and S. H. Chiao Sep. 1978 43 p refs
(Contract DAAB07-78-C-2402)
(AD-A065537; IR-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

Lattice-matched InGaAsP avalanche photodiodes have been fabricated for detection of light in the 1.0 - 1.3 micron wavelength range. Uniform gains of 15 and quantum efficiencies of 63% have been achieved. Leakage current for 7-mil diameter APDs is under 5 nA until 70% of the breakdown voltage, but increases rapidly for higher voltages, and is ultimately the main cause of limited device performance. Experiments suggest that the leakage current is surface dominated, so that guard rings can be built to substantially improve performance. Author (GRA)

N79-24273# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
BASIC STUDIES OF HIGH PERFORMANCE MULTIALKALI PHOTOCATHODES Final Report, 1 Sep. 1974 - 31 Aug. 1978
Clayton W. Bates, Jr. 5 Mar. 1979 127 p refs
(Contract DAAG29-75-C-0003)
(AD-A066064) Avail: NTIS HC A07/MF A01 CSCL 09/1

X-ray photoemission studies (XPS) of Cs3Sb, Na2KSb, and Na2KSb(Cs) alkali antimonide photocathodes prepared in ultrahigh vacuum on pyrex, suprasil quartz, and stainless steel substrates have been made. The results for these surfaces are the same. Employing the concept of the Auger Parameter we demonstrate that the most photosensitive alkali-antimonide photoemitters are ionic semiconductors with a direct correlation between degree of ionicity and photosensitivity. We further show the dependence of photoemission threshold on lattice constant and ionicity. It is concluded from these studies that the structure of the most photosensitive s-20 consists of a surface layer of K2CsSb upon a base layer of Na2KSb and not a monolayer of CS upon Na2KSb as we commonly thought. Author (GRA)

N79-24274# Naval Avionics Center, Indianapolis, Ind.
DELETERIOUS EFFECT OF MIL-F-14256, TYPE RA FLUXES ON PRINTED WIRING BOARDS Technical Report, 1 Jan. 1978 - 1 Jan. 1979
David O. Pond 31 Jan. 1979 58 p
(AD-A066129; NAC-TR-2253) Avail: NTIS HC A04/MF A01 CSCL 09/5

This study identified the corrosive effects of Type RA fluxes and flux residues on printed wiring boards subjected to electrical stress in a humid environment at elevated temperature. The effect of varying delay times between soldering and cleaning of flux residues was also studied and the protective value of solder resist and conformal coating was evaluated. Author (GRA)

N79-24275# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
HIGH POWER MILLIMETER WAVE AMPLIFIER
S. Heji and Howard Jory Griffiss AFB, N. Y. RADC Dec. 1978 36 p refs
(Contract F30602-78-C-0011; ARPA Order 3192)
(AD-A062966; RADC-TR-78-235) Avail: NTIS HC A03/MF A01 CSCL 09/1

The measured performance of a three cavity gyroklystron amplifier designed to operate at X-band with the signal frequency near the second harmonic of the cyclotron frequency is described. Efficiency and gain were measured as a function of various operating parameters. Performance of the experimental device was significantly limited by the need to avoid spurious oscillations. The maximum gain was 10 db and the maximum efficiency was 8 percent. Noise figure and spectrum measurements yielded values similar to high-tower linear beam tubes. Design considerations for converting the experimental gyroklystron to a gyro-TWT are discussed. A gyro-TWT using the TE(1) cylindrical mode with exiaring hardware. Considerations for a second experiment using the TE01 cylindrical mode and the second cyclotron harmonic are also discussed. J.M.S.

N79-24276# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
HIGH IMPACT SHOCK EVALUATION OF THE DIODE ASSEMBLY DESIGN USED IN A 3000-HORSEPOWER GENERATOR
Terry S. Ericsen Mar. 1979 49 p refs
(AD-A066143; DTNSRDC/PAS-78-34) Avail: NTIS HC A03/MF A01 CSCL 09/1

Two 'flat-pak' diode assemblies were evaluated under high impact shock conditions. The results indicate that the assembly design is suitable for use in Navy shipboard equipment, given locking nuts are used for the spring clamp system. It was also recommended that the thickness of the assembly mounting bar be increased in order to improve vibration characteristics. Author (GRA)

N79-24277# Naval Research Lab., Orlando, Fla.
ONR-NRL SUPERCONDUCTING MATERIALS SYMPOSIUM: A FORECAST
T. L. Francavilla, D. U. Gubser, and S. A. Wolf Jan. 1979 157 p refs Symp. held at Washington, D. C., 29 Sep. 1978 (RR0210346)
(AD-A066201; AD-E000267; NRL-MR-3906) Avail: NTIS HC A08/MF A01 CSCL 20/3

Partial Contents: Ternary Compounds; Granular Superconductors; Superconductivity in (SN)x and its Halogen Derivative (SNBr0.4)x; Studies of cuCl at Elevated Pressures; Superconducting Properties of Hydride Systems; Thin Film Superconducting Materials Research; Synthesis of Superconducting Nb3Si using High Pressures; Synthesis of Unstable A-15 Compounds by Epitaxial Recrystallization of Ion Implanted Layers; and Sputtering of Nb3Si. GRA

N79-24278# Bendix Corp., Kansas City, Mo.
LOGIC CIRCUIT SIMULATION AND AUTOMATIC FABRICATION Final Report
W. W. Davis Feb. 1979 58 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2070-Rev) Avail: NTIS HC A04/MF A01

A computer aided system was investigated to assist in performing required digital designs. The system contained graphics, digital simulation, PROM circuit synthesis, and numerical control (N/C) wiring control tape software. DOE

N79-24279# Bendix Corp., Kansas City, Mo.
CONTAMINANT IDENTIFICATION FOR AN ELECTROMECHANCAL UNIT Final Report
F. A. Clay and G. E. Crabtree Mar. 1979 30 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2116-Rev) Avail: NTIS HC A03/MF A01

Several sources of particulate and organic contamination on piece parts of a complex electromechanical unit were identified and established as causing contact loop resistance and torque failures in some assembled units. One source, alumina particulates, was reduced by developing a circuit board polishing technique. Another source, fractured glass fibers, was minimized by applying a polyurethane coating to the switch block assembly. Some organic contaminants were effectively reduced by plasma cleaning the piece parts and subassemblies. Not all sources of contamination have been identified and corrected to date. DOE

N79-24280# National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1979
William E. Reed Mar. 1979 74 p Supersedes NTIS/PS-78/0174; NTIS/PS-77/0158; NTIS/PS-76/0122; NTIS/PS-75/190
(NTIS/PS-79/0142/4; NTIS/PS-78/0174; NTIS/PS-77/0158; NTIS/PS-76/0122; NTIS/PS-75/190) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Federally-sponsored research on the design, development, fabrication, and applications of electron beam semiconductor devices is reported. Applications include amplifiers, pulse generators, image tubes, switches, and electron beam memory devices. This updated bibliography contains 67 abstracts, 2 of which are new entries to the previous edition. GRA

N79-24281# National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1979
William E. Reed Mar. 1979 87 p Supersedes NTIS/PS-78/0175; NTIS/PS-77/0159; NTIS/PS-76/0123
(NTIS/PS-79/0143/2; NTIS/PS-78/0175; NTIS/PS-77/0159; NTIS/PS-76/0123) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Research on the design, development, fabrication, performance, and applications of electron beam semiconductor devices is presented. Applications include amplifiers, image tubes, memory devices, pulse generators, and electron beam pumped semiconductor lasers. This updated bibliography contains 81 abstracts, 5 of which are new entries to the previous edition. GRA

N79-24282# National Bureau of Standards, Washington, D. C.
SOME THOUGHTS ON ELECTRICAL CONNECTIONS
Jacob Rabinow Aug. 1978 35 p
(PB-290491/0; NBSIR-78-1507) Avail: NTIS HC A03/MF A01 CSCL 09A

Electrical connections, in general, and aluminum wiring for homes, in particular are discussed. It is concluded that present day technology of electrical distribution wiring in residences is not in keeping with good engineering practices available. This is true relative to both copper and aluminum wiring. GRA

N79-24283# National Bureau of Standards, Washington, D. C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: MICROELECTRONIC PROCESSING LABORATORY AT NBS Interim Report, 1973 - 1978
T. F. Leedy and Y. M. Liu Dec. 1978 37 p refs
(ARPA Order 2397)
(PB-291790/4; NBS-SP-400/53; LC-78-26038) Avail: NTIS HC A03/MF A01 CSCL 09A

The facilities and processes used at NBS for the fabrication of npn silicon transistors in support of the process control and measurement technology are described. Details of techniques used for contamination control, and the various steps required for the preparation of planar silicon transistors are included. The electrical properties of the devices is also discussed. GRA

N79-24284*# National Bureau of Standards, Washington, D. C. National Engineering Lab.
LOOSE-PARTICLE DETECTION IN MICROELECTRONIC DEVICES Final Report, Jul. 1977 - Jun. 1978
John S. Hilten, Paul S. Lederer, J. Franklin Mayo-Wells, and Carol F. Vezzetti Oct. 1978 69 p refs
(NASA Order S-39193-B)
(PB-290679/0; NBSIR-78-1590; NASA-CR-158666) Avail: NTIS HC A04/MF A01 CSCL 09E

An evaluation of the test procedures and apparatus specified in MIL-STD-883, Test Method 2020, Particle Impact Noise Detection test is described. The comparison of procedures and apparatus presented is based on the use of specially prepared specimen device packages known either to have or not to have a particle present. The characterization of the accelerations imparted to a specimen device by pre- and co-shock apparatus is reported along with a brief study of the effectiveness of couplant materials in transmitting mechanical energy to the specimen device, and a comparison of the output signal level from four different ultrasonic detection transducers under otherwise identical test conditions. GRA

N79-24733*# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
COMPOSITE OSCILLATOR SYSTEMS FOR MEETING USER NEEDS FOR TIME AND FREQUENCY
S. R. Stein and F. L. Walls *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. Planning Meeting Nov. 1978 p 17-35 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09A

N79-24735*# Frequency and Time Systems, Inc., Danvers, Mass.
ACCELERATION SENSITIVITY COMPENSATION IN HIGH PERFORMANCE CRYSTAL OSCILLATORS
Donald A. Emmons *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 55-83 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09A

N79-24737*# Ecole Nationale Superieure de Chimie de Paris (France).
QUARTZ CRYSTAL AND SUPERCONDUCTIVE RESONATORS AND OSCILLATORS
Raymond S. Besson *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 101-130 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N79-24285* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLUID SAMPLE COLLECTION AND DISTRIBUTION SYSTEM Patent
Richard L. Brooks, inventor (to NASA) (Boeing Aerospace Co., Houston, Tex.) Issued 24 Apr. 1979 9 p Filed 4 Apr. 1978 Supersedes N78-22590 (16 - 13, p 1734) Sponsored by NASA
(NASA-Case-MSC-16841-1; US-Patent-4,151,086; US-Patent-Appl-SN-893382; US-Patent-Class-210-108; US-Patent-Class-210-142; US-Patent-Class-73-714) Avail: US Patent and Trademark Office CSCL 20D

A multipoint fluid sample collection and distribution system is provided wherein the sample inputs are made through one or more of a number of sampling valves to a progressive cavity pump which is not susceptible to damage by large unfiltered particles. The pump output is through a filter unit that can provide a filtered multipoint sample. An unfiltered multipoint sample is also provided. An effluent sample can be taken and applied to a second progressive cavity pump for pumping to a filter unit that can provide one or more filtered effluent samples. The second pump can also provide an unfiltered effluent sample. Means are provided to periodically back flush each filter unit without shutting off the whole system.

Official Gazette of the U.S. Patent and Trademark Office

N79-24286 California Inst. of Tech., Pasadena.
A CHEMICALLY REACTING, TURBULENT SHEAR LAYER Ph.D. Thesis
Robert Edward Breidenthal, Jr. 1979 86 p
Avail: Univ. Microfilms Order No. 7911620

A chemically reacting turbulent shear layer was investigated

in a new, blow-down water tunnel. In a diffusion-limited reaction, a pH indicator in one stream mixed and reacted with a base in the other stream to form a visible reaction product. Using optical densitometry techniques, the amount of product was measured as a function of Reynolds number, at a relatively high Schmidt number of approximately 600. The product was distributed, in concentrated lumps associated with the large, spanwise-coherent structures of the turbulence. The time averaged amount of product in the layer exhibited a rapid transition at a large-structure Reynolds number of about 5,000 for a velocity ratio of 0.38. Above the transition, the amount of product within the layer was independent of Reynolds number. Dissert. Abstr.

N79-24287 California Univ., San Diego.
NUMERICAL CALCULATIONS OF PERIODIC GRAVITY-CAPILLARY WAVES Ph.D. Thesis
James Warner Rottman 1978 234 p
Avail: Univ. Microfilms Order No. 7909828

The general problem of steady, two dimensional, gravity-capillary waves on an interface between two fluids of different densities is formulated in terms of a pair of nonlinear integro-differential equations. The pair of equations is shown to reduce to a single integro-differential equation for the special case of free surface waves. Perturbation solutions of these equations are found and are seen to agree with existing small amplitude approximation solutions. An iterative method for the accurate numerical solution of these equations is developed and a procedure for estimating the error in the method is presented. The method is applied to a number of different cases of periodic waves in an unbounded fluid. Dissert. Abstr.

N79-24288 Colorado Univ. at Boulder.
THE EFFECTS OF FINITE SIZE ON THE CRITICAL BEHAVIOR OF FLUID FILMS Ph.D. Thesis
Benno Abbott Scheibner 1978 126 p
Avail: Univ. Microfilms Order No. 7911472

The results of refractive index studies performed on films of a critical mixture of 2,6-lutidine+water near the lower critical point are presented. The films ranged in thickness from 0.46 to approximately 300 micrometers and were confined between the highly reflecting surfaces of a pair of optical flats in an interferometer. Above the critical temperatures of these films, in the two-phase region, delta n, which is the difference between the refractive indexes of the two phases was measured. Since to a close approximation delta n is proporitional to the order parameter, measurements of delta n as a function of temperature map out the coexistence curves of the films. For each film of thickness less than 6 micrometers a crossover was observed from three dimensional to two dimensional scaling behavior. Each of these films has crossover temperature at which the shape of the coexistence curves change markedly. Dissert. Abstr.

N79-24289 Colorado Univ. at Boulder.
ROTATIONAL FLOWS IN ELECTRICALLY CONDUCTING AND NON-CONDUCTING FLUIDS Ph.D. Thesis
Sin-Sung Chen 1978 83 p
Avail: Univ. Microfilms Order No. 7911434

Concerning rotational flows, the validity of a boundary condition used in the numerical computation of viscous flow problems is examined and the behavior of a swirling flow through tubes of varying radius is studied, treating the fluid as inviscid. In a fluid region weakly affected by the body force, a slip wall can be used to approximate a realistic no-slip solid surface if the Reynolds number is reasonably large. In a region where the body force has a strong effect, a no-slip wall may never be replaced by a slip wall even if the Reynolds number is extremely high. The problem of swirling flow through tubes with abrupt contraction or expansion is solved using the method of matching up- and down-stream solutions. There is no restriction on the rotational speed of the flow in this analytical method. In all solved cases, the secondary flows and wave patterns are displayed at various Rossby numbers. Dissert. Abstr.

N79-24290 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF NAVIER-STOKES EQUATIONS FOR WIDE RANGE OF TWO DIMENSIONAL INCOMPRESSIBLE INTERNAL FLOW PROBLEMS USING BOUNDARY-FITTED CURVILINEAR COORDINATES Ph.D. Thesis
Dilip Kumar 1978 163 p
Avail: Univ. Microfilms Order No. 7909336

An implicit finite difference method was applied to solve the unsteady viscous flow problems for a wide range of two dimensional internal flows. The solution was obtained by first generating coordinate systems numerically. The two physical coordinates were generated by solving two elliptic partial differential equations with Dirchlet of Neumann boundary conditions. The coordinate systems were solved on a transformed plane which consisted of combinations of rectangular regions with square mesh. Once the coordinate system was generated for a given geometric configuration, the Navier-Stokes Equations in primitive variables were transformed to the rectangular transformed plane. Dissert. Abstr.

N79-24291 Louisiana State Univ. and A&M Coll., Baton Rouge.
TRANSPORT PROPERTIES OF BINARY MIXTURES OF DENSE HARD-SPHERE FLUIDS Ph.D. Thesis
William Andrew McElhannon, Jr. 1978 126 p
Avail: Univ. Microfilms Order No. 7911578

The Enskog-Thorne solution to the Boltzman equation provides expressions for the transport properties of binary dense fluid mixtures of hard spheres. The Percus-Yevick approximation is used for the virial equation of state to evaluate the Thorne expressions and obtain mixing laws for thermal conductivity and viscosity. These expressions are compared with experimental results to help correlate the excess transport properties. The expression for viscosity is applied to a dilute suspension of macromolecules and certain simplifications result. A dependence of specific viscosity on macromolecular size is predicted. Recent modifications show that the Enskog theory produces results for thermal diffusivity identical to those obtained by McLaughlin when he chose the chemical potential gradient instead of the concentration gradient as the diffusive driving force. Dissert. Abstr.

N79-24292 West Virginia Univ., Morgantown.
HEAT TRANSFER SIMULATION IN UNDERGROUND COAL LIQUEFACTION Ph.D. Thesis
Fred Ku Fong 1978 140 p
Avail: Univ. Microfilms Order No. 7910896

The heat transfer problem of a solvent flowing in a cylindrical channel embedded in a medium with a moving boundary is described. Three nonlinear conjugated differential equations describe the process. Numerical methods were devised to solve these three differential equations simultaneously. The numerical methods consist of a combination of two stable methods, namely the ADI iteration method for the parabolic equation and the alternating variable method for the hyperbolic equations. These two methods give very fast convergence and are well suited to nonlinear equations. It was concluded that: the heat loss from the solvent through the coal seam via thermal conduction is negligible and the boundary velocity and thermal conductivity of coal have strong influence on the boundary temperature. Dissert. Abstr.

N79-24293 Drexel Univ., Philadelphia, Pa.
MODELING AND VERIFICATION OF HEAT PUMP PERFORMANCE FOR INDUSTRIAL ENERGY CONSERVATION Ph.D. Thesis
Ramachandran Narayanan 1979 219 p
Avail: Univ. Microfilms Order No. 7909905

A detailed mathematical simulation of a water-to-water industrial heat pump was developed. A 2kw heat pump employing refrigerant -12 which was locally designed and built was operated in the laboratory. Performance data from the experiment was used to verify the heat pump component and system mathematical models. The four major components of the heat pump cycle, viz., evaporator, condenser, compressor and expansion valve were modeled individually and were coupled together with a system pressure and flow balance. The horizontal evaporator and condenser with tube side water coolant were modeled, employing the NTU-effectiveness techniques with published heat transfer coefficients including change of phase. The reci coefficients including change of phase. The reciproacting compressor was modeled as a thermodynamic process incorporating the effects of clearance, cylinder intake and discharge processes and motor efficiency. Dissert. Abstr.

N79-24294 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL INVESTIGATION OF THE NATURAL CONVECTION BOUNDARY LAYER OVER A UNIFORM FLUX INCLINED SURFACE Ph.D. Thesis
Hussain Shaukatullah 1977 108 p
Avail: Univ. Microfilms Order No. 7911617

A thermocouple and two hot-film anemometer probes in the form of inverted V were used to investigate the boundary layer formed over an inclined surface dissipating a uniform heat flux. Temperature and the longitudinal and transverse components of velocity were measured. The presence of longitudinal vortices caused a spanwise variation of temperature and velocity which results in spanwise variation of heat transfer. For a uniform flux surface the spanwise variation occurred first for angles greater than 11 deg. The location of the beginning of transition was found to depend on the distance from the leading edge, in addition to the Grashof number. The hot-film probes were calibrated by using a Disa 55HO1 traversing mechanism. This method allows calibration over a fairly wide range of speeds and permited simulation of flow direction from vertical to horizontal. Dissert. Abstr.

N79-24295*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
THERMAL AND FLUID FLOW ANALYSES OF SOUNDING ROCKET EXPERIMENT 74-21/2R AND 74-21/3R Final Report
S. J. Robertson Apr. 1979 73 p refs
(Contract NAS8-32422)
(NASA-CR-161224; LMSC-HREC-TR-D568959) Avail: NTIS HC A04/MF A01 CSCL 20D

The thermal convective velocities during the 4-21/2R and 74-21/3R flight tests were calculated. The 74-21/2R and 74-21/3R ground tests were analyzed using a convection formula. Thermal convection velocities of 0.1 to 0.5 cm/sec were calculated for the 74-21/2R and 74-21/3R ground tests which were two to four orders of magnitude greater than for the flight tests. For the 74-21/2R flight test, solutal effects do not produce any convective motion. For the 74-21/3R flight test closed form convection equations estimated the solutal convective velocities on the order of 1/0.003 cm/sec. M.M.M.

N79-24296*# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
MANTLE: A FINITE ELEMENT PROGRAM FOR THE THERMAL-MECHANICAL ANALYSIS OF MANTLE CONVECTION. APPENDIX E: PROGRAM LISTING Final Report
Erik Thompson May 1979 81 p
(Grant NGR-06-002-191)
(NASA-CR-158632) Avail: NTIS HC A05/MF A01 CSCL 20D

A program listing for a finite element computer code for the analysis of mantle convection is provided. J.M.S.

N79-24297*# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
MANTLE: A FINITE ELEMENT PROGRAM FOR THE THERMAL-MECHANICAL ANALYSIS OF MANTLE CONVECTION. A USER'S MANUAL WITH EXAMPLES Final Report
Erik Thompson May 1979 115 p refs
(Grant NGR-06-002-191)
(NASA-CR-158631) Avail: NTIS HC A06/MF A01 CSCL 20D

A finite element computer code for the analysis of mantle convection is described. The coupled equations for creeping viscous flow and heat transfer can be solved for either a transient analysis or steady-state analysis. For transient analyses, either a control volume or a control mass approach can be used. Non-Newtonian fluids with viscosities which have thermal and spacial dependencies can be easily incorporated. All material parameters may be written as function statements by the user or simply specified as constants. A wide range of boundary conditions, both for the thermal analysis and the viscous flow analysis can be specified. For steady-state analyses, elastic strain rates can be included. Although this manual was specifically written for users interested in mantle convection, the code is equally well suited for analysis in a number of other areas including metal forming, glacial flows, and creep of rock and soil. J.M.S.

N79-24298*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN, FABRICATION AND TEST OF A HYDROGEN HEAT PIPE Final Report
J. Alario Feb. 1979 76 p refs
(Contract NAS2-9291)
(NASA-CR-152267) Avail: NTIS HC A05/MF A01 CSCL 20D

Re-entrant groove technology was extended to hydrogen heat pipes. Parametric analyses are presented which optimize the theoretical design while considering the limitations of state-of-the-art extrusion technology. The 6063-T6 aluminum extrusion is 14.6 mm OD with a wall thickness of 1.66 mm and contains 20 axial grooves which surround a central 9.3 mm diameter vapor core. Each axial groove is 0.775 mm diameter with a 0.33 mm opening. An excess vapor reservoir is provided at the evaporator to minimize the pressure containment hazard during ambient storage. Modifications to the basic re-entrant groove profile resulted in improved overall performance. While the maximum heat transport capacity decreased slightly to 103 w-m the static wicking height increased markedly to 4.5 cm. The heat pipe became operational between 20 and 30 K after a cooldown from 77 K without any difficulty. Steady state performance data taken over a 19 to 23 K temperature range indicated: (1) maximum heat transport capacity of 5.4 w-m; (2) static wicking height of 1.42 cm; and (3) overall heat pipe conductance of 1.7 watts/deg C. A.R.H.

N79-24299*# Vought Corp., Dallas, Tex.
DEVELOPMENT OF A PROTOTYPE FLEXIBLE RADIATOR SYSTEM Final Report
C. W. Hixon [1979] 286 p refs
(Contract NAS9-14776)
(NASA-CR-160166; Rept-2-30320/9R-52078) Avail: NTIS HC A13/MF A01 CSCL 20D

The radiator is a roll-up flexible panel with the transport fluid manifolds located at the ends of the 27 foot length. A total of fifty Teflon flow tubes are sandwiched between the layers of silver wire mesh and sealed in the Teflon film. The transport fluid flows from an inlet manifold through 25 panel flow tubes to the end of the radiator panel into a manifold which directs the fluid into the other 25 flow tubes on its return to the base of the radiator. Deployment/retraction of the flexible radiator panel is by low pressure inflation tubes (one along each side of the panel) which incorporate a flat spring. The spring supplies the retraction force to wind the radiator panel on a drum when the pressure in the inflation tubes is relieved. Room ambient deployment tests of the radiator panel were conducted to verify the inflation tube spring deployment, and retraction capability. The panel underwent a thermal vacuum, solar spectrum exposure test. After approximately 100 hours of solar exposure, post-test inspection revealed no structural or optical properties degraded. R.E.S.

N79-24300# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
SOME EXPERIMENTAL OBSERVATIONS OF THE FLOW THROUGH GAUZE SCREENS
T. A. Thomson Sep. 1978 39 p refs
(ATN-7804) Avail: NTIS HC A03/MF A01

The flow through gauze screen discs mounted in a wind tunnel was studied visually and their drag coefficients were measured. The expansion of the streamtub intercepted by the screens was found to be adequately well predicted by one-dimensional actuator-disc theory. However, the measured variation of screen drag coefficient with resistance coefficient k agreed closely with theoretical predictions only when $k < 4$. The separation bubble downstream of screen elements reported by other investigators was observed visually. It existed only when k was equal to or < 4, and the variation of its form and location with k was recorded. Author

N79-24301# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
THE FLOW THROUGH A GAUZE SCREEN
T. A. Thomson Jan. 1978 28 p refs

(ATN-7801) Avail: NTIS HC A02/MF A01

The incompressible flow through a resistive screen located in a straight duct is analysed one-dimensionally. The solutions are of two types. One predicts regular flow for all screen resistances and ratios of screen-to-duct area, A'/S. The other predicts anomalous flow, i.e. reversal of the flow far downstream of the screen, under some conditions of A'/S when the screen resistance coefficient, K, exceeds 4.0 When A'/S = 0, a common solution, indicating zero velocity far downstream of the screen appears. If the flow is regular, the screen drag coefficient, CD' exceeds unity and increases as A'/S increases. If the flow is anomalous, CD < 1 and vanishes when the screen resistance coefficient is infinite. Solution of the anomalous-flow type cannot represent real flows. Nevertheless, when A'/S and k are compatible with the existence of a solution of this type, it appears that a flow represented by the alternative, regular-flow solution does not occur in practice. Author

N79-24302*# Computer Sciences Corp., Hampton, Va.
A MARCHING METHOD FOR CALCULATING LINE AND CONTINUUM RADIATION IN HIGH ENERGY FLOW FIELDS
Charles W. Bolz, Jr. Jun. 1979 28 p refs
(Contract NAS1-12527)
(NASA-CR-3046) Avail: NTIS HC A03/MF A01 CSCL 20D

A method is presented for calculating nongrey radiative fluxes and intensities in a highly ionized, low temperature plasma with extreme line broadening. The method was developed to study radiative heating phenomena in the mass-injected hypersonic shock-layer environments characteristic of outer planet atmospheric entry, although it is not limited to such studies. The radiative properties model assumed local thermodynamic equilibrium and used standard continuum and molecular band models. The atomic line model, however, used a frequency-marching method for the frequency integration, which not only accounted completely for line overlapping (reabsorption) effects, but compared favorably in economy with the best equivalent-width methods. An assessment of hydrogen line-far-wing treatments, with recommendations for engineering models, is also presented. Author

N79-24303# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
TURBULENT BOUNDARY LAYER STRUCTURE AND DRAG REDUCTION Final Scientific Report, 1 Jun. 1974 - 14 Dec. 1978
M. T. Landahl and S. E. Widnall Feb. 1979 17 p
(Grant AF-AFOSR-2730-74)
(AD-A065667; AFOSR-79-0205TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The work under this grant has consisted of a fairly broadly aimed theoretical analysis along several fronts with the aim of understanding the basic mechanisms responsible for the creation of turbulence in a boundary layer and the possible use of this knowledge to explain observed phenomena of turbulent drag reduction through polymer addition, etc., as well as to be able to propose new and improved drag reducing methods. The work has progressed along three main lines of attack which are: (a) Theoretical modeling of boundary-layer turbulence; (b) Mechanisms involved in laminar-turbulent transition in a boundary layer; and (c) Drag reduction mechanisms. Author (GRA)

N79-24304# California Univ., San Diego. Dept. of Applied Mechanics and Engineering.
THE STRUCTURE OF TURBULENT VELOCITY FIELDS Final Report
F. H. Champagne 26 Nov. 1978 10 p
(Grant AF-AFOSR-3172-77; AF Proj. 2307)
(AD-A065666; AFOSR-79-0204TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

An experimental investigation of relaminarization of turbulent pipe flow subjected to a large decrease in Reynolds number was continued. A considerable amount of data on the downstream development of the flow field using both single wires and x-wires was obtained. For Re - 2000 the turbulence cannot sustain itself and the flow relaminarizes with the rate of relaminarization being greater the lower the Reynolds number. The mean velocity profiles exhibit a gradual trend towards a parabolic profile with increasing x/d. The nature of the flow field for 1900 - Re - 2800 was shown to be particularly interesting as puffs or incipient puffs exist in the flow for x/d = 40. Detection of puffs imbedded in the decaying turbulent flow is difficult so an iterative puff waveform eduction program was developed. Valuable results from the program include the average incipient waveform in an incipient puff, the average length of puffs, the mean time puffs, and other structural features of the puffs at various downstream locations. This information is useful in understanding the origin and evolution of puffs in transitional pipe flow. The existence of puffs in the present study as well as a previous transition study indicates that they play a fundamental role in the transition and reverse transition process. GRA

N79-24305# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
STABILITY AND AMPLIFICATION OF SHOCK WAVES
Paul Harris Dec. 1978 41 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A066108; AD-E400277; ARLCD-TR-78041) Avail: NTIS HC A03/MF A01 CSCL 19/1

The concept of shock wave instability leading to shock pressure amplification is investigated with respect to materials properties and thermodynamic equilibrium. It is concluded that a materials property requirement (negative macroscopic Grueneisen parameter) associated with single-pass pressure amplification is inconsistent with the amplifying medium being in a state of thermodynamic equilibrium. A resulting interpretation, for inert media, is that such amplifying states are metastable and only to be found in materials which are in the process of undergoing a phase transition. As a consequence, it is argued that practical shock pulse pressure amplification is not a possibility.
Author (GRA)

N79-24306# Battelle Columbus Labs., Ohio.
STUDY OF HEAT TRANSFER THROUGH REFRACTORY LINED GASIFIER VESSEL WALLS Quarterly Progress Report, Apr. - Jun. 1978
J. Richard Schorr Jun. 1978 53 p
(Contract EX-76-C-01-2210)
(FE-2210-29) Avail: NTIS HC A04/MF A01

An available furnace was used to conduct tests at atmospheric pressure. A second furnace was build to conduct high pressure tests. The apparatus determines the effects of gas atmosphere, anchor position, and pressure level on heat transfer and temperature profiles in the refractories that are being measured. Checkout work was completed on the high-pressure test apparatus (HPTA), including the pressure control and safety system; the high-pressure test specimen was fabricated; and a procedure for conducting the high-pressure test was formulated. Several modifications to the HPTA and pressure control and safety systems was implemented in order to provide more reliable and safe operation of the systems during the heat transfer measurement tests. DOE

N79-24307# Brookhaven National Lab., Upton, N. Y.
COST-EFFECTIVE POTENTIAL OF OPTIMUMLY DESIGNED HEAT PUMPS FOR THE COLLECTION, STORAGE, AND DISTRIBUTION OF SOLAR ENERGY
J. G. Cottingham Nov. 1978 10 p refs Presented at ASHRAE Symp. on Air Infiltration, Philadelphia, 28 Jan. - 1 Feb. 1979 Submitted for publication
(Contract EY-76-C-02-0016)
(BNL-25195; Conf-790112-3) Avail: NTIS HC A02/MF A01

Various solar heat pump configurations are reviewed and the assisted or series configuration identified as the concept having the greatest potential for economic acceptance. The system impact that would result from the development of vapor commpression equipment specially tuned to the collection and distribution of solar energy is examined. Major impacts on the solar collector and energy storage elements are identified and reviewed. Solar collectors of crude and inexpensive design, including some passive-like structures, are found to be acceptable in performance and highly desirable economically. Also uninsulated in-the-ground storage found to be beneficial gaining energy from the ground in winter and dissipating it in summer. DOE

N79-24308# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft-und Raumfahrtkonstruktionen.
HIGHER ORDER METHODS FOR TRANSIENT DIFFUSION ANALYSIS
J. H. Argyris, L. E. Vaz, and K. J. Willam 1979 53 p refs
(ISD-222) Avail: NTIS HC A04/MF A01

The finite element approach to transient heat conduction and moisture migration problems was examined. Several finite time algorithms were then compared with Pade approximations and alternative Norsett formulas. The individual time operators were investigated with regard to accuracy of the incremental algorithm, stability and implications on the integration of stiff systems, and computational implementation of higher order operators. After a thorough assessment of each family an incremental step by step algorithm is presented in which the solution of the linear expansion is corrected for higher order accuracy. To this end an iterative improvement technique was developed which does not destroy the sparse structure of the initial system matrices or increase their order. Numerical examples to compare the solution effort and the accuracy of the different operators are given. Author (ESA)

N79-24309# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
DIFFUSION AND HEAT TRANSFER IN A PLANE HORIZONTAL FILM [DIFFUSION ET TRANSFERT DE CHALEUR DANS UN FILM PLAN HORIZONTAL]
R. Prudhomme (Univ. Pierre et Marie Curie, Paris) and M. Dudeck Aug. 1977 50 p refs In FRENCH; ENGLISH summary Presented at 5th Conf. Intern. de Thermodyn. Chim., Ronneby Swed., 23-26 Aug. 1977
(Rept-77-2; Publ-543) Avail: NTIS HC A03/MF A01

The influence of diffusion mass transfer and conduction heat transfer on the propagation of small amplitude waves through a medium composed of a condensed phase of infinite depth covered by a horizontal film was studied. Two distinct problems were investigated and it was proven that these two problems lead to similar solutions. The first problems involves mass transfer through a heterogeneous medium. The exchange between the volume and the film is produced by a process of adsorption-desorption. An effect of surface diffusion takes place in the film. The second problem concerns the study of thermal conduction in a condensed phase at rest. The heat exchange between the film and the volume is considered irreversible. The effect of the superficial heat transfer was examined. Small near equilibrium movements of the system were studied. The influence of the adsorption-desorption kinetics (or of the exchange coefficient) and the influence of the surface diffusion (or of the heat conduction of the surface) were particularly examined. Author (ESA)

N79-24310# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
GRAVITY WAVES AND DIFFUSION IN A LIQUID COVERED BY A SUPERFICIAL FILM [ONDE DE GRAVITE DANS UN LIQUIDE AVEC FILM SUPERFICIEL ET DIFFUSION]
M. Dudeck (Univ. Pierre et Marie Curie, Paris) and R. Prudhomme Jul. 1978 34 p refs In FRENCH Presented at 3d Congr. Franc. de Mecan., Grenoble, France, 6-9 Sep. 1977
(Rept-77-3; Publ-544) Avail: NTIS HC A03/MF A01

Propagation of gravity waves by a process of adsorption-desorption through a medium composed of a condensed phase of infinite depth and covered by a thin film was studied using theoretical models. The nonexistence of a monochromatic solution to the system of equations obtained suggests a solution involving the interaction of two waves. One corresponds to the diffusion phenonmenon in the medium, the other to the velocity of the liquid. Two dispersion equations result. The solutions to these equations are discussed in function of the exchange between the medium and the film. The resulting model also considers slip between the medium and the film, an unequal adsorption-desorption factor, and a film surface tension as a function of the total surface mass and the surface of the diffusing species. Particular attention is given to the influence of kinetic adsorption on the first wave equation and to the influence of diffusion on the second. Author (ESA)

N79-24311# Oxford Univ. (England). Engineering Lab.
MULTI-FLUID, HIGH TEMPERATURE CAVITATION TUNNEL: DESCRIPTION AND OPERATING MANUAL
M. R. Mussared 1977 21 p refs
(OUEL-1196/77) Avail: NTIS HC A02/MF A01

The cavitation tunnel described allows precise control of the temperature and pressure of the circulating fluid and enables the provision or extraction of vapor to develop cavities on the test body. Detailed operating instructions are provided.
Author (ESA)

N79-24312# Oxford Univ. (England). Engineering Lab.
VISCOUS EFFECTS ON CAVITATION INCEPTION ON A TWO DIMENSIONAL CYLINDER
M. E. P. Wykes 1978 62 p refs
(Grant SRC-B/RG/71746)
(OUEL-1225/78) Avail: NTIS HC A04/MF A01

Experiments were performed in a variable temperature cavitation tunnel with a two-dimensional circular cylinder as the test body to determine the relationship between cavitation inception characteristics of the test body and the change in the fully-wetted flow regime which occurs in the critical Reynolds number region. In the Reynolds number range considered (1.2 x 100,000 less than R sub d less than 8.5 x 100,000) three modes of limited cavitation occurred. At Reynolds numbers corresponding approximately to the subcritical range for fullywetted flow, cavitation inception was observed to occur in the wake downstream of the body. At Reynolds numbers broadly in the supercritical range for fully-wetted flow, up to a value of about 5.5 x 100,000, band type attached cavitation inception occurred across the downstream faces of the cylinder at about 110 deg from the upstream stagnation point. At Reynolds numbers greater than about 5.5 x 100,000, cavitation inception was of the attached spot type occurring at discrete spanwise locations. Author (ESA)

N79-24313# Oxford Univ. (England). Engineering Lab.
IDENTIFICATION OF FLOW TYPE USING HEATED THIN FILMS
R. Lobel Apr. 1978 55 p refs
(OUEL-1238/78) Avail: NTIS HC A04/MF A01

A series of experiments are described that use heat transfer rates from heated thin films to determine transition and separation in a mainstream flow similar to that encountered on the suction surface of a turbine. The mean findings show that in a separation bubble the r.m.s. variation heat transfer is significantly higher than in attached flow and that the signal frequencey spectrum is slightly narrower in separated flow. It was also found that transition occurring in a separation bubble is characterized by a different signal shape from turbulence spots than from those in attached flow transition. Author (ESA)

N79-24314# Oxford Univ. (England). Engineering Lab.
VAPOUR FLOWS AND HEAT CONDUCTANCES IN VENTILATED CAVITIES BEHIND A TWO-DIMENSIONAL CYLINDER. PART 1: REVIEW OF ENTRAINMENT AND THERMODYNAMIC EFFECT; VISCOUS EFFECTS ON LIMITED AND DEVELOPED CAVITATION
M. E. P. Wykes 1978 82 p refs
(Contract B-RH-71746)
(OUEL-1245/78) Avail: NTIS HC A05/MF A01

Types of gas and vapor entrainment found in natural and ventilated cavity flows about circular and certain other bluffed bodies are discussed. Methods for analyzing the thermodynamic effect are reviewed and, on the basis of an analysis using entrainment theory, it is that vapor ventilation offers advantages over foreign gas ventilation techniques. Experiments were performed, using a high temperature cavitation tunnel, that show strong viscous effects on cavitation inception form for both limited and developed cavitating flow regimes. Author (ESA)

N79-24315 This accession not used.

N79-24316# National Technical Information Service, Springfield, Va.
HEAT PUMPS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1979
Audrey S. Hundemann Apr. 1979 182 p Supersedes NTIS/PS-78/0165
(NTIS/PS-79/0232/3; NTIS/PS-78/0165) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Technical and economic feasibility of extracting heat from one temperature source and delivering the thermal energy extracted for use at a higher temperature is discussed in abstracts of Federally-sponsored research. Air to air, air to water, and water to water heat pump systems are covered with reference to residential, commercial, and industrial applications. Performance and reliability studies of heat pumps, including solar assisted heat pumps, for residential heating are emphasized. This update bibliography contains 175 abstracts, 81 of which are new entries to the previous edition. GRA

N79-24317# National Technical Information Service, Springfield, Va.
HEAT PUMPS, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977
Audrey S. Hundemann Apr. 1979 249 p
(NTIS/PS-79/0233/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Design, performance, and applications of heat pumps are discussed in abstracts from worldwide literature. The heat pumps, which extract heat from one temperature source and deliver the extracted heat for use at a higher temperature are discussed with regard to their energy conserving potential in residential, commercial, and industrial applications. Air to air, air to water, and water to water heat systems are covered. The use of heat pumps, including solar assisted heat pumps, in heating and cooling of buildings and heating of swimming pools is emphasized. This updated bibliography contains 242 abstracts, none of which is new to the previous edition. GRA

N79-24318# National Technical Information Service, Springfield, Va.
HEAT PUMPS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Jan. 1979
Audrey S. Hundemann Apr. 1979 120 p Supersedes NTIS/PS-78/0166
(NTIS/PS-79/0234/9; NTIS/PS-78/0166) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Abstracts from worldwide literature related to the use of heat pumps in the heating of swimming pools and the heating and cooling of buildings are presented. The reliability, thermal efficiency, and energy saving potential of air, air to water, and water to water systems are covered in this updated bibliography which contains 113 abstracts, all of which are new to the previous edition. GRA

N79-24319# National Technical Information Service, Springfield, Va.
CAVITY FLOW, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 252 p Supersedes NTIS/PS-78/0188; NTIS/PS-77/0034 and NTIS/PS-76/0041 (NTIS/PS-79/0259/6; NTIS/PS-78/0188; NTIS/PS-77/0034; NTIS/PS-76/0041) Avail: NTIS HC A12/MF A01 CSCL 20D

Shallow and deep configurations, holes, cutouts, hollows, notches, gaps, orifces, flaps, and steps are discussed. Applications include: bomb bays, aerodynamic windows, microwave cavities, resonators, bearings, diffusers, and jets. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-24320 British Broadcasting Corp., Kingswood (England).
DIGITAL RECORDING USING HOLOGRAM ARRAYS: LASER-BEAM DEFLECTION AND MODULATION
K. Hacking and I. Childs Mar. 1979 38 p refs
(BBC-RD-1979/6) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The feasibility of optical methods of recording a digital television signal in real-time depends inter-alia on the successful development of devices for modulating and deflecting laser beams. For recording using the holographic approach, these devices must be able to handle many data channels in parallel and be optically efficient. Various methods have been investigated, and the more promising solutions are examined here in more detail. It is concluded that a solid-state digital light deflector together with a PLZT page composer could, with some further development, meet the basic recording requirements for digital television signals. For replay, an acoustic-optic deflector of modest resolving power is eminently suitable. Author

N79-24321 British Library Lending Div., Boston Spa (England).
INFLUENCE OF AIR CHARACTERISTICS ON THE CALIBRATION OF A VARIABLE-AREA FLOWMETER
J. Flesselles Mar. 1979 14 p refs Transl. into ENGLISH from Ann. du Tabac (France), no. 14, section 1, 1976 p 125-136
(BLL-RTS-11718) Avail: British Library Lending Div., Boston Spa, Engl.

The effects of the air temperature, moisture, and pressure were considered in the calibration of a flowmeter utilized in the testing of cigarette filters. Equations were solved in the calculation of the floating gas in the variable area of the filter. M.M.M.

N79-24322 British Library Lending Div., Boston Spa (England).
THE HOLOGRAPHIC RECORDING OF A MOVING WATER AEROSOL
Ye. M. Birger and L. N. Razumov 19 Jul. 1979 11 p refs Transl. into ENGLISH from Tsent. Aerol. Obs., T. Vyp (Moscow), no. 13, 1977 p 73-80
(BLL-Trans-1370-(9022.549)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Research was carried out with a holographic camera to study atmospheric aersolos at ground level, primarily, transparent particles of aerosol in the liquid and solid phases. The distribution of the particles with speed along with the shape of crystals in clouds are recorded using the pulsed holography method described. M.M.M.

N79-24323*# National Aeronautics and Space Administration, Washington, D. C.
HOT-WIRE AND HOT-FILM ANEMOMETRY
C. Rasmussen and B. B. Madsen May 1979 18 p refs Transl. into ENGLISH from Arch. Tech. Mess. (West Germany), Feb. 1978 p R17-R22 Original language document was announced as A68-23626 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by DISA Elektronik A/S, Herlev, Denmark
(Contract NASw-3198)
(NASA-TM-75413) Avail: NTIS HC A02/MF A01 CSCL 14B

The circuit techniques, electronics, dynamic properties, and the applications of the anemometers are given. M.M.M.

N79-24324# Army Missile Research and Development Command, Redstone Arsenal, Ala.
A COOKBOOK FOR DICHROMATED GELATIN HOLOGRAMS
D. Guenther and C. D. Leonard 12 Jan. 1979 15 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A065642; DRDMI-T-79-17) Avail: NTIS HC A02/MF A01 CSCL 14/5

Gelatin sensitized by ammonium dichromate(DGH) produces a near-optimum medium for holography. Holograms produced in this medium have very low scattering noise and very high diffraction efficiencies. This report summarizes techniques found to be useful in producing high quality holograms. Author (GRA)

N79-24325# Rochester Univ., N. Y. Coll. of Engineering and Applied Science.
STUDIES OF PHOTOGRAPHIC GRAIN IN A COHERENT OPTICAL SYSTEM: SIGNAL-DEPENDENCE AND ITS IMPLICATIONS
Scott A. Armstrong 1978 8 p refs Repr. from SPIE vol. 137 Airborne Reconnaissance 3, 1978 p 24-30
(Grant DAAG29-77-G-0014)
(AD-A062528; ARO-14101.1-GS) Avail: NTIS HC A02/MF A01 CSCL 14/5

The signal-dependence of photographic grain is easily demonstrated by studying the first order statistics (mean and variance) of the scattered light in a coherent optical spectrum analyzer. It is shown empirically and from simple theoretical considerations that the granularity of the photographic material can be determined using a coherent measurement and can be interpreted as an inverse signal to noise ratio. The traditional linear Fourier domain filter can be shown by simple considerations to be ill-suited for dealing with the signal-dependence of photographic grain. GRA

N79-24326# Oxford Univ. (England). Engineering Lab.
FEASIBILITY STUDY OF THE APPLICATION OF SELF-TUNING CONTROLLERS TO CHEMICAL BATCH REACTORS
Hans Erik Horn 1978 85 p refs Sponsored in part by UK Sci. Res. Council and NTNF
(OUEL-1248/78) Avail: NTIS HC A05/MF A01

A method for adaptive control of the temperature of a chemical batch reactor is described. Through hybrid simulations the controller was proved feasible. The estimation part of the controller was also proved feasible when applied to online experiments on the real plant. The hybrid simulations were not carried as far as desired, mainly due to limited time available. Several more experiments related to parameter variations in the process should be carried out before the complete controller is applied to the real plant. Results show that hybrid simulation as a development tool is very useful, as indicated by plant experiments. As a controller development programming language, Real-Time Tiny Basic is also efficient and easy to use. SESAME provides the combination of computing power and transportability that makes it a highly versatile controller development aid.
Author (ESA)

N79-24327# Cincinnati Univ., Ohio. Southwestern Ohio Regional Computer Center.
AUTOMATION OF AN ULTRAVIOLET-VISIBLE SPECTROMETER
Dennis P. Ryan Dec. 1978 39 p refs
(Contract EPA-GS-05S-10458)
(PB-290831/7; EPA-600/4-78-064) Avail: NTIS HC A03/MF A01 CSCL 14B

An overview is presented for the functional description and major features of an automated ultraviolet-visible spectrometer system intended for environmental measurements application. As such, it defined functional specifications and requirements which were divided into the chlorophyll, color multioption, and quality control modules. The general system design methodology is discussed with regard to the EPA laboratory automation project. The interfacing hardware requirements were included in general terms only. GRA

N79-23900*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FURTHER DEVELOPMENTS IN SIMPLE TOTAL ENERGY SENSORS
Oran W. Nicks *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 219-246 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-24328 New Mexico State Univ., University Park.
EXPERIMENTAL LASER ANEMOMETRY AND ANALYSIS OF ELECTROMAGNETIC WAVES IN MOVING MEDIA Ph.D. Thesis
Ruben Rodriguez 1978 195 p
Avail: Univ. Microfilms Order No. 7909471

Two projection dyadics, P and Q, were defined. These dyadics facilitate direct and inverse Lorentz transformations of four-dimensional vectors and electromagnetic field vectors. Next, the condition necessary for the existence of the wave equation in a moving medium was considered and the dispersion equation, applicable to moving media, was derived and partially checked by examining several simplifying cases. The laser anemometer experimental prototype sensor, a device capable of measuring wind velocities remotely, was evaluated. As energy is backscattered by atmospheric particulates, the receiver collects signals from two closely spaced sample volumes by means of range gating. Cross correlation analysis of the signals yields a time delay which is inversely proportional to the wind component transverse to the laser beam. Results of the evaluation test show the feasibility of measuring wind remotely in quasi-real-time.
Dissert. Abstr.

N79-24329*# International Laser Systems, Inc., Orlando, Fla.
Nd:YAG DEVELOPMENT FOR SPACEBORNE LASER RANGING SYSTEM Final Report, Jan. 1976 - Feb. 1979
Lawrence L. Harper, K. Edward Logan, Robert H. Williams, and Don A. Stevens Feb. 1979 310 p refs
(Contract NAS5-22916)
(NASA-CR-159932) Avail: NTIS HC A14/MF A01 CSCL 20E

The results of the development of a unique modelocked laser device to be utilized in future NASA space-based, ultraprecision laser ranger systems are summarized. The engineering breadboard constructed proved the feasibility of the pump-pulsed, actively modelocked, PTM Q-switched Nd:YAG laser concept for the generation of subnanosecond pulses suitable for ultra-precision ranging. The laser breadboard also included a double-pass Nd:YAG amplifier and provision for a Type II KD*P frequency doubler. The specific technical accomplishment was the generation of single 150 psec, 20-mJ pulses at 10 pps at a wavelength of 1.064 micrometers with 25 dB suppression of pre-and post-pulses. G.Y.

N79-24330# Aerodyne Research, Inc., Bedford, Mass.
INITIATION PHENOMENA IN PULSED CHEMICAL LASERS Final Report, 8 Aug. 1977 - 17 Nov. 1978
James P. Moran and R. Bruce Doak Oct. 1978 99 p refs
(Contracts N00173-77-C-0222)
(AD-A065885; ARI-RR-139) Avail: NTIS HC A05/MF A01 CSCL 20/5

It has been proposed that trace addition of ClF3 to conventional gas mixtures in photo-initiated HF/DF pulsed lasers might substantially improve chain reaction initiation and consequently, system electrical efficiency. It has further been proposed that steady flow of a spatially tailored trace addition of ClF3 might improve uniformity of initiation and, hence, cavity homogeneity in reptitively pulsed devices by providing enhanced initiation (F-atom production) in regions of diminished lamp illumination. An argon filled flash lamp with pulse duration (FWHM) of approximately 40 microsec was observed to radiate 3.5% of its initial electrical energy in the absorption band of ClF3 (1750A to 2400A) and 13% of its energy in the absorption band of F2

(2400A to 3400A). Theoretical modeling of flash lamp radiation indicates that short lamp pulses appropriate to pulsed chemical lasers would show equal or better radiation distribution of lamp electrical energy in these absorption bands. The flash lamp was used in photolysis studies which show that absorption of radiation by ClF3 results in dissociation with efficiency of order unity. Photolytic production of F-atoms could not be determined in the present UV attenuation studies due to the occurrence of a strongly absorbing unidentified photolysis product or products. GRA

N79-24331# Brown Univ., Providence, R. I. Engineering Div.
RESEARCH IN GAS LASERS Final Report, 1 Jan. - 31 Dec. 1978
T. F. Morse 1979 9 p refs
(Grant AF-AFOSR-2645-74)
(AD-A065743; AFOSR-79-0246TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The work on the rate equation descriptions of pulse propagation in homogeneous media is complete and is being prepared for publication. The Pulse duration limit was chosen as long compared to the coherence time so that true coherence effects such as self-induced transparency is absent. However, the system of rate equations are velocity dependeningt so Doppler broaden mechanisms are included. Attempts have continued to determine if it is possible to utilize a plasma break down in air to deduce velocity. Thus far, it has been determined that the magnitude of the scattered signal provides ample signal for short ranges. This technique will prove useful where conventional Doppler velocimetry is not possible due to the absence of naturally occurring scattering centers. The density matrix equations for three energy level gases have been formulated. For situations where the pulse or pumping time is longer than a dephasing time, the rate equations explicity contain contributions that are nonlinear. Author (GRA)

N79-24332# University of Southern California, Los Angeles.
EXCIMER POTENTIAL CURVES Annual Report, 1 Jan. - 31 Dec. 1978
H. S. Taylor, M. Valley, and C. Watts 1 Mar. 1979 42 p refs
(Contract N00014-77-C-0102; ARPA Order 2840)
(AD-A066043; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes the present status of our effort to develop and implement semi-empirical and theoretical methods for obtaining potential curves of diatomic excimer systems. The basic theory of the semi-empirical electron scattering model is reviewed and the results of preliminary calculations on LiHe are presented. Author (GRA)

N79-24333# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Group.
HIGH ENERGY RESONANCE TRANSFER LASER STUDY Technical Report, 24 Jul. - 31 Dec. 1978
P. Baily, J. Finzi, G. Holleman, K. Hui, and J. Wang Jan. 1979 72 p refs
(Contracts N00173-78-C-0470; DASG60-77-C-0056; F33615-78-C-1477; DARPA Order 2062)
(AD-A065926; HAC-FR-79-73-538; HAC-REF-E2380) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report describes the first half of an experimental study of the HF laser pumped Optical Resonance Transfer Laser (ORTL). Several molecular systems were investigated including HF/HBr, HF/DF, HF/HCl, and HF/HCN as well as the optically pumped HF laser. The latter exhibited the best overall performance in quantitative fluorescence spectroscopy experiments and laser demonstration experiments. New laser systems demonstrated were optically pumped HF, and the HF/DF (3.8 micrometers) and HF/HCN (3.9 micrometers) ORTL systems. Laser oscillation was achieved at pressures ranging from 25 torr to 110 torr. A maximum output power of 20 watts was achieved in the optically pumped HF laser. Author (GRA)

N79-24334# Oklahoma State Univ., Stillwater. Dept. of Physics.
MULTISTEP ENERGY MIGRATION AND RADIATIONLESS RELAXATION PROCESSES IN PHOSPHOR AND LASER CRYSTALS Final Report, 1 Jan. 1976 - 31 Dec. 1978
Richard C. Powell 31 Dec. 1978 298 p refs
(Contract DAAG29-76-G-0099)
(AD-A066086; ARO-113318.8-P) Avail: NTIS HC A13/MF A01 CSCL 20/5

This report covers the work supported by the US Army Research Office. The research involves the utilization of new laser techniques such as time-resolved site-selection spectroscopy and photoacoustic spectroscopy to characterize multistep energy transfer and radiationless relaxation processes in phosphor and laser materials. GRA

N79-24335# Pennsylvania Univ., Philadelphia. School of Medicine.
CYTOCHEMICAL STUDY RELATED TO LASER APPLICATION Final Report, 1 Jul. 1974 - 30 Sep. 1977
K. C. Tsou Dec. 1978 27 p refs
(Contract DAMD17-74-C-4143; DA Proj. 3E7-62772-A-813; DA Proj. 3A1-61102-B-71P)
(AD-A065671) Avail: NTIS HC A03/MF A01 CSCL 20/5

The use of laser has been on the increase in recent years. Protection against hazards created by the use of this new versatile tool in modern science has hence become necessary. The current consensus standard is that of ANSI Z136.1-1973. The Army has also set its own standard, and the Bureau of Radiological Health has also studied the criteria related to laser safety. While guidelines and control procedures have been stipulated by these agencies, fundamental biological effects data are required for evaluating exposure criteria for laser radiations. In the area of research related to the safety of the eye, cornea deserves investigation, since retention of a smooth, transparent cornea is of major importance in maintaining normal vision. The integrity of this surface could very well be challenged particularly for infrared lasers (lambda greater than 1.4 microns) where the laser energy is absorbed by the cornea or outer ocular media. Clinically, such damage could be checked through visual inspection with a slit lamp. If a permanent visual opacity is produced at the time of the radiation insult or develops as a chronic effect, a corneal transplant may be required. Author (GRA)

N79-24336# Textron Bell Aerospace Co., Buffalo, N. Y.
NUMERICAL MODEL DEVELOPMENT FOR LASER CAVITY FLOWFIELDS Interim Report, 31 May 1977 - 31 May 1978
J. T. Schimke and W. L. Rushmore May 1978 70 p refs
(Contract F49620-77-C-0076; AF Proj. 2304)
(AD-A065836; Rept-9278-950001; AFOSR-79-0085TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A recently developed subroutine package for the integration of systems of ordinary differential equations by implicit methods is tested on a variety of gas dynamic problems. These problems include one-dimensional unsteady gas flow and two and three-dimensional parabolic (steady) Navier-Stokes problems. The governing partial differential equations were converted to systems of ordinary differential equations using either finite differences or finite elements, and then integrated by the implicit integration package. Included among the examples is a realistic steady laser cavity flow problem. Author (GRA)

N79-24337# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
THEORETICAL MODELING OF MOLECULAR AND ELECTRON KINETIC PROCESSES. VOLUME 1: THEORETICAL FORMULATION OF ANALYSIS AND DESCRIPTION OF COMPUTER PROGRAM Final Technical Report, 12 Jun. 1978 - 15 Jan. 1979
William B. Lacina Jan. 1979 240 p refs
(Contract N00014-78-C-0499)
(AD-A066155; NRTC-79-TR-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 20/5

This report describes and documents a comprehensive and reasonably general computer analysis applicable to a broad class of transient, electrically excited laser systems. The theoretical model is formulated, for a spatially homogeneous medium, in terms of the coupled set of equations which describe the molecular kinetics, electron kinetics, external discharge circuit, and optical radiative extraction. One of the unique features of the present code is that the molecular kinetic subroutines for an arbitrary

reaction scheme are synthesized automatically by translation of an input queue of symbolically expressed reactions into computer-coded FORTRAN equations, which are automatically coupled to a Boltzmann analysis of electron kinetics. The electron kinetics analysis consists of numerical solutions of the Boltzmann equation for the electron energy distribution. The technique for solution permits inclusion of inelastic binary electron-molecule collisions, superelastic collisions, electron-electron collisions, momentum transfer (with recoil), a source term for external creation of electrons (at zero energy and over a distribution of energies) by sources of ionization, and retention of the term proportional to dn sub e/dt for situations involving a net change in the electron density. From the electron energy distribution, all of the plasma parameters, electron excitation rates, and power partitioning can be obtained. GRA

N79-24338# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
THEORETICAL MODELING OF MOLECULAR AND ELECTRON KINETIC PROCESSES. VOLUME 2: FORTRAN COMPUTER PROGRAM LISTINGS, GENERALIZED LASER KINETICS SYNTHESIS AND ANALYSIS, BOLTZMANN ELECTRON KINETICS ANALYSIS Final Technical Report, 12 Jun. 1978 - 15 Jan. 1979
William B. Lacina Jan. 1979 131 p refs
(Contract N00014-78-C-0499)
(AD-A066156; NRTC-79-TR-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/5

Volume I of this report describes and documents a comprehensive and reasonably general computer analysis applicable to a broad class of transient, electrically excited laser systems. The theoretical model is based on a coupled analysis of molecular kinetics, electron kinetics, external driving circuit, and radiative extraction. A complete discussion has been given in Volume I. Volume II contains the FORTRAN listing for these programs and their subroutines, which were developed for the CDC 6000 and CYBER series computer system. Author (GRA)

N79-24339# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
VARIATIONAL APPROACH TO NONLINEAR SELF-FOCUSING OF GAUSSIAN LASER BEAMS
D. Anderson and M. Bonnedal 1977 19 p refs Prepared jointly with UKAEC Culham Lab.
(CTH-IEFT/PP-1977-11) Avail: NTIS HC A02/MF A01

The problem of nonlinear self-focusing of Gaussian laser beams was reformulated in terms of a variational principle. By means of approximating Gaussian functions, expressions were obtained for the equilibrium radii and nonlinear frequency shifts of stationary self-trapped laser beams. Unsteady propagation is given an illuminating form in terms of a potential function description. The analysis confirms recent results obtained by moment theory as opposed to those based on paraxial ray approximations. Author (ESA)

N79-24340# United Kingdom Atomic Energy Authority, Abingdon (England). Theory Division.
INTERPRETATION OF ENHANCED LASER-PLASMA BACKSCATTERING DUE TO PREPULSE RADIATION
D. Anderson (Chalmers Univ. of Technol.) and H. Wilhelmsson (Chalmers Univ. of Technol.) Goteborg Chalmers Univ. of Technol. Sep. 1977 6 p refs
Avail: NTIS HC A02/MF A01

Noise generated by a laser prepulse was studied as a possible explanation of prepulse stimulation of backscattering. Prepulse was assumed to give rise to an enhanced noise level, part of which still persists when the main pulse arrives on target. Results support a model where the noise introducted by the prepulse has a significant effect on backscattering in laser produced plasmas. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-24341 British Library Lending Div., Boston Spa (England).
METHOD FOR DETERMINING THE STATE OF A FUEL MIXTURE AT THE INLET MANIFOLD OF AN M 207 MOTOR UNDER NON-ADIABATIC CONDITIONS
M. Sova Apr. 1979 6 p Transl. into ENGLISH from Brasov Bull. (Romania), v. 18B, 1976 p 17-19
(BLL-RTS-11509) Avail: British Library Lending Div., Boston Spa, Engl.

An element is defined of the evaporating surface at an inlet manifold considering heat and material exchange to be established between the drops of fuel and air, and with a heating medium for a motor M 207. The state of a mixture of fuel is determined at the end of the process by the use of graphic representations of the saturation temperature vs. the moisture content. M.M.M.

N79-24342 British Library Lending Div., Boston Spa (England).
TWO-STAGE SUPERCHARGER SETS: EFFICIENCY AND HEAD DISTRIBUTION UNDER FULL- AND PART-LOAD CONDITIONS
Hanns-Guenther Bozung Mar. 1979 26 p refs Transl. into ENGLISH from Motortech. Z. (West Germany), v. 39, no. 5, 1978 p 209-215
(RTS-11613) Avail: British Library Lending Div., Boston Spa, Engl.

The following topics are discussed: (1) exhaust gas turbocharger requirements; (2) limits of single-stage exhaust gas turbocharging; (3) possibilities of two-stage exhaust gas turbocharging; (4) efficiency; and (5) part-load performance. G.Y.

N79-24343 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF AIR FLOW PROCESSES IN THE COMBUSTION CHAMBERS OF DIRECT-INJECTION DIESEL ENGINES
Rade Jankov Feb. 1979 12 p Transl. into ENGLISH from Motortech. Z. (West Germany), v. 39, no. 6, 1978 p 255-257
(RTS-11620) Avail: British Library Lending Div., Boston Spa, Engl.

A formula for the calculation of air eddies occurring in a cylindrical combustion chamber during the compression stroke of the direct injection diesel engine is described. The definitions and evaluations of specific instant energy expressed in terms of time and the total flow energy, as well as the mean flow velocity, the energy-specific mean velocity of the gas flowing through the chamber throat, and the specific mass flow of the radial flow are presented. By using the similarity law, all results are applied to diesel engines of different sizes, and different combustion chamber designs. The results obtained during the flow of gas through the chamber throat are valid for the flow through the connecting passage of the divided chamber-type diesel engines, provided the pressure differences in both chambers are neglected. Author

N79-24344 Engineering Sciences Data Unit, London (England).
GREASE LIFE ESTIMATION IN ROLLING BEARINGS
1978 16 p Also published as ISSN-0141-2590
(ESDU-78032; ISBN-0-85679-236-5) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 HC E99

For rolling bearing applications where the operating load and speed conditions are not severe grease lubrication often provides a cheaper and simpler alternative to oil lubrication; the design of housing and sealing, and bearing installation and maintenance are all simplified. In such applications, grease life is usually shorter than the fatigue life, which depends on the material properties of the bearing elements and is calculated in accordance with standard methods. A method is given for estimating, the grease life in rolling bearings for (1) determining the relubrication interval, K, (2) determining the grease renewal period, R, and (3) determining the life of sealed-for-life bearings. ESDU

N79-24345 British Library Lending Div., Boston Spa (England).
PNEUMATIC CARBURATION (PC) FOR INTERNAL COMBUSTION ENGINES WITH SPARK IGNITION
May 1979 9 p Transl. into ENGLISH from Podstawy Budowy Silnikow Spalinowych (Poland), 1978 p 54-58
(BLL-RTS-11758) Copyright. Avail: British Library Lending

Div., Boston Spa, Engl.

A standard engine with a compression ratio increased to 8.5 was used in tests to validate the priciples of the pneumatic carburation spark system. The performance results are:(1) an output increase of 30%; (2) a maximum effective pressure increase of 20% and (3) a reduction of fuel consumption by 30%. In terms of the exhaust gas toxicity, a reduction in the content of toxic gas is obtained. M.M.M.

N79-24346 British Library Lending Div., Boston Spa (England).
INVESTIGATIONS INTO MIXTURE PREPARATION AND COMBUSTION IN THE HYDROGEN ENGINE
K. W. Drexl, H.-P. Holzt, D. Hassel, ed., K. Rompe, ed., and F. Haber, ed. Apr. 1979 16 p refs Transl. into ENGLISH of the book "Entwicklungslinien in der Kraftfahrzeugtechnik" Cologne, Verlag Tuv Rheinland GmbH, 1977 p 236-244
(BLL-RTS-11807) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The main objective during the development of the hydrogen engine is to operate the generally well knowh and proven combustion engine with reciprocating pistons on a hydrogen/air mixture and at the same time to preserve the advantageous properties with respect to economy, reliability, power per unit weight and readiness for use whilst optimization for low emission of pollutants and high thermal efficiency or good utilization of the fuel are particularly important criteria. The special physical properties of hydrogen, such as for example the wide limits fo flammability, low ignition energy, high burning velocity of the stoichiometric mixture and high rate of diffusion may necessitate the development of special means for prevention of such undesirable effects as backfiring into the induction pipe, premature ignition during the compression stroke, knocking, steep pressure increase and associated harsh noise. L.S.

N79-24347 British Library Lending Div., Boston Spa (England).
THE 1.11 NEW CONSIDERATIONS ON THE DEVELOPMENT OF VORTEX PORTS
L. Thon Apr. 1979 14 p refs Transl. into ENGLISH from "Podstawy Budowy Silnikow Spalinowych" West Germany p 106-114
(BLL-RTS-11759) Copyright. Avail: British Library Lending Div, Boston Spa, Engl.

The development of satisfactory vortex ports for small cylinders and small stroke-bore ratios is presented. The application of branched vortex ports is promising, but further development is necessary. Good results are achieved with conventional vortex intake ports if the flow out of the valve opening is controlled by the outer wall of the vortex chamber and by the shape of its roof. An improvement on the anemometer speed is accomplished by the adaptation of the valve shape to a given port. This has negligible influence on the rate of air flow or flow resistance. Port D IX described was tested on a 1-cylinder experimental engine. The performance gives encouragement for development on a small capacity direct-injection engine. M.M.M.

N79-24348 British Library Lending Div., Boston Spa (England).
THE ACCELERATION AND BRAKING CAPABILITY OF HYDROSTATIC TRANSMISSIONS
H. Nikolaus May 1979 16 p refs Transl. into ENGLISH from Olhydraulik und Pneumatik (West Germany), v. 21, 1977 p 499-501
(BLL-RTS-11821) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A description is given of the relationships between the primary and secondary torque values during static transmission. The problems arising from the interference of signals in the production of defined acceleration and braking processes are reported. M.M.M.

N79-24349*# Wyle Labs., Inc., Huntsville, Ala.
EVALUATION OF SHABERTH: A BEARING SIMULATION COMPUTER PROGRAM Final Report
12 Dec. 1978 56 p
(Contract NAS8-31904)
(NASA-CR-161205) Avail: NTIS HC A04/MF A01 CSCL 13I

To investigate lubrication effects on bearing thermal performance, an investigation was performed to determine the feasibility of using the SKF program SHABERTH for simulating the performance of cryogenically lubricated ball bearings. As a part of this study, the particular application chosen for SHABERTH was to simulate the performance of the Space Shuttle main engine turbo-pump and pre-burner bearing system. L.S.

N79-24350*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIAGNOSTICS OF WEAR IN AERONAUTICAL SYSTEMS
L. D. Wedeven 1979 5 p refs Presented at the 15th State-of-the-Art Symp. on Corrosion and Wear, Washington, D. C., 4-6 Jun. 1979; sponsored by the Am. Chem. Soc.
(NASA-TM-79185; E-052) Avail: NTIS HC A02/MF A01 CSCL 20K

Maintenance costs associated with the transmissions and drive train greatly increase the maintenance burden and failure risk. Detection measurements fall under two general categories of vibration and particle detectors. The latter are more amenable to tracking wear. Wear debris analysis can supply a great deal of information such as: particle concentration, rate of change in concentration, composition, particle size and shape, principal metals, etc. It is not economically feasible to monitor all variables. At least one role of the lubrication and wear specialist is to provide guidance in selecting the most appropriate variables to monitor. R.E.S.

N79-24351*# Battelle Columbus Labs., Ohio.
DEVELOPMENT AND EVALUATION OF DIE AND CONTAINER MATERIALS. LOW COST SILICON SOLAR ARRAY PROJECT Final Report
R. R. Wills and D. E. Niesx May 1979 100 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954876)
(NASA-CR-158670; DOE/JPL-954876-79/16) Avail: NTIS HC A05/MF A01 CSCL 13D

Specific compositions of high purity silicon aluminum oxynitride (Sialon) and silicon beryllium oxynitride (Sibeon) solid solutions were shown to be promising refractory materials for handling and manipulating solar grade silicon into silicon ribbon. Evaulation of the interaction of these materials in contact with molten silicon indicated that solid solutions based upon beta-Si3N4 were more stable than those based on Si2N2O. Sibeon was more resistant to molten silicon attack than Sialon. Both materials should preferably be used in an inert atmosphere rather than under vacuum conditions because removal of oxygen from the silicon melt occurs as SiO enhances the dissolution of aluminum and beryllium. The wetting angles of these materials were low enough for these materials to be consided as both die and container materials. R.E.S.

N79-24352*# Marquardt Corp., Van Nuys, Calif.
BISTABLE (LATCHING) SOLENOID ACTUATED PROPELLANT ISOLATION VALVE Final Report
H. Wichmann and H. H. Deboi 22 May 1979 56 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954824)
(NASA-CR-158673; S-1480) Avail: NTIS HC A04/MF A01 CSCL 13K

The design, fabrication, assembly and test of a development configuration bistable (latching) solenoid actuated propellant isolation valve suitable for the control hydrazine and liquid fluorine to an 800 pound thrust rocket engine is described. The valve features a balanced poppet, utilizing metal bellows, a hard poppet/seat interface and a flexure support system for the internal moving components. This support system eliminates sliding surfaces, thereby rendering the valve free of self generated particles. R.E.S.

N79-24353# Navy Experimental Diving Unit, Panama City, Fla.
TEST AND EVALUATION OF MAKO HIGH-PRESSURE BREATHING AIR COMPRESSOR KA-51-DF
D. E. Dodds Dec. 1978 37 p refs
(AD-A065553; NEDU-21-78) Avail: NTIS HC A03/MF A01 CSCL 13/7

A diesel engine driven high-pressure breathing air compressor, MAKO model KA-51-DF, was evaluated by the Navy Experimental Diving Unit to determine its suitability for Navy use. Results of the 100-hour endurance test showed that the portable compres-

sor delivers breathing air at an average charge rate of 4.8 CFM, charging twin 71.2 cu. ft. and twin 90 cu. ft. scuba tanks in 25 and 31 minutes respectively. The unit is easily maintained, sturdily constructed, and economical in diesel fuel consumption. GRA

N79-24354# Mechanical Technology, Inc., Latham, N. Y. Research and Development Div.
INVESTIGATION OF MAGNETIC FIELDS AND FORCES ARISING IN CLOSED- AND OPEN-CIRCUIT-TYPE MAGNETIC SUSPENSION SYSTEMS Final Technical Report
H. S. Nagaraj, J. A. McCormick, and J. A. Walowit Feb. 1979 151 p refs
(Contract N00014-78-C-0098)
(AD-A065923; MTI-79TR35) Avail: NTIS HC A08/MF A01 CSCL 13/9

Magnetic bearings can employ either closed- or open-type magnetic circuits. A theory that was developed, for predicting forces and fluxes in closed-circuit-type magnetic systems employing high-permeability material was reported earlier. This theory had only been validated through measurements under static conditions. In this work, several aspects of both closed- and open-circuit-type magnetic systems have been studied. Dynamic measurements of forces and fluxes have been made in a closed magnetic circuit to detect any possible effects due to a transverse oscillation of one of the members forming the magnetic circuit. Although the measurements discovered some degradation of transverse forces with frequency, the phase angle measured between the force and the displacement indicated very little damping in the system. Towards the study of open-circuit magnetic systems, a theory has been developed for predicting repulsive forces (normal and transverse) between high coercivity permanent magnets. This theory has been based on the mathematical modeling of permanent magnets by their equivalent current densities. The analytical results have been compared with repulsive forces measured between two rectangular parallelopiped-shaped magnets, and an excellent agreement has been found. GRA

N79-24355# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 2: BALL BEARINGS Interim Report, Apr. 1976 - Oct. 1977
A. B. Jones and J. M. McGron, Jr. Feb. 1978 115 p refs (Contract F33615-76-C-2038)
(AD-A065554; SRC-78-TR-29-Pt-2; AFAPL-TR-78-6-PT-2) Avail: NTIS HC A06/ MF A01 CSCL 13/9

This report is an update of the original Part IV of the Rotor-bearing Dynamics Design Technology Series, AFAPL-TR-65-45 (Parts I through X). A Computer program is given for preparation of ball bearing stiffness data input for rotordynamic response programs. The complete stiffness matrix is calculated including centrifugal effects. Considerations such as elastohydrodynamic and cage effects are not included since they have little influence on the calculation of ball bearing stiffness. The resulting program is reasonably small and easy to use. Lastly, the stiffness data included in the original Part IV have been updated and are included in appendices. Author (GRA)

N79-24356# Mechanical Technology, Inc., Latham, N. Y.
THE BALANCE OF ROLLERS FOR HIGH DN BEARINGS Final Report, 1 May - 15 Nov. 1977
Martin Eusepi and Pradeep Gupta 28 Mar. 1978 103 p refs (Contract F33615-77-C-3100; AF Proj. 3048)
(AD-A065899; MTI-78TR27; AFAPL-TR-78-9) Avail: NTIS HC A06/MF A01 CSCL 13/9

A gas bearing spin-up device has been built for determining the residual unbalance remaining in rollers for high speed bearing applications after the rollers have successfully completed the manufacturing and final inspection process. The device has successfully determined the mean unbalance in a group of 30 rollers to be in the range of .000005 to .0000056 in.-oz. per end with a standard deviation in the range of .0000027 to .0000033 in.-oz. The spin-up device uses capacitance type non-contacting sensors to measure the roller's response. The measurement resolution has been determined to be .000002 inch and its sensitivity approximately 250 volt/inch. For the roller investigated, the minimum measurable unbalance is approximately .000005 in.-oz. In a second phase of this study, a complement of 32 rollers, screened for minimum unbalance in the balancing fixture, was assembled into a zero radial clearance bearing which was then tested to 2.5 million DN under a 500-lb. radial load. At the conclusion of 40 test hours, four of the rollers in the above bearing were replaced with four new rollers which were deliberately unbalanced. An additional 40 test hours at 2.5 million DN and 500-lb. radial load were logged with no visible effects caused by the roller unbalance. Author (GRA)

N79-24357# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
HYDRODYNAMIC LUBRICATION WITH WEAR AND ASPERITY CONTACT IN MECHANICAL FACE SEALS Summary Report, 1 Dec. 1970 - 30 Nov. 1978
A. O. Lebeck, J. L. Teale, and R. E. Pierce Jan. 1979 191 p refs
(Contract N00014-76-C-0071)
(AD-A065924; ME-95(79)ONR-414-1) Avail: NTIS HC A09/MF A01 CSCL 11/1

Mechanical face seals are used in numerous applications in Naval Machinery. These applications range from propeller shaft seals to boiler feed pump seals. In such equipment the mechanical seal plays a vital role. When such seals fail, repair is costly both in terms of lost time and direct cost, so any improvement in seal life and reliability would be of significant benefit. As more advanced equipment is designed, it is sometimes difficult to achieve desired performance in more severe service environments with the present state of the art of design. Thus, an improvement in seal technology would serve this important application. The immediate objective of the research herein is to further the understanding of mechanical face seal lubrication phenomena. The ultimate objective is to develop the capability of designing contacting face seals having a longer life, greater reliability, and for extreme environments. Thus, the objectives of this research are compatible with mechanical face seal needs for Naval machinery. Author (GRA)

N79-24358# National Highway Traffic Safety Administration, Washington, D. C. Technology Assessment Div.
AUTOMOTIVE FUEL ECONOMY CONTRACTOR'S COORDINATION MEETING
1978 427 p refs Meeting held in Washington, D. C., 11-13 Dec. 1978
(PB-290516/4; DOT-HS-803-706) Avail: NTIS HC A19/MF A01 CSCL 10A

This document is intended to be an effective and timely means of broadly disseminating a full and up-to-date review of the automotive fuel economy research and analysis program objectives and progress. Topic areas covered include: Fuel economy and emissions considerations; Motor vehicle demand forecasting; Consumer research; Engines; Weight reduction; and Industrial behavior. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-24359*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER SIGNAL PROCESSING FOR ULTRASONIC ATTENUATION AND VELOCITY MEASUREMENTS FOR MATERIAL PROPERTY CHARACTERIZATIONS
Alex Vary 1979 19 p refs Presented at the 12th Symp. on Nondestructive Evaluation, San Antonio, Tex., 24-26 Apr. 1979; cosponsored by the Am. Soc. for Nondestructive Testing and the Southwest Res. Inst.
(NASA-TM-79180; E-048) Avail: NTIS HC A02/MF A01 CSCL 14D

Instrumentation and computer programming concepts that were developed for ultrasonic materials characterization are described. Methods that facilitate velocity and attenuation measurements are outlined. The apparatus described is based

on a broadband, buffered contact probe using a pulse-echo approach for simultaneously measuring velocity and attenuation. Instrumentation, specimen condition, and signal acquisition and acceptance criteria are discussed. Typical results with some representative materials are presented. L.S.

N79-24360# Martin Marietta Aerospace, Orlando, Fla.
RELIABILITY TRADE-OFFS FOR UNIT PRODUCTION COST Final Technical Report, Jun. 1977 - May 1978
Thomas W. Butler Jan. 1979 72 p refs
(Contract F30602-77-C-0118)
(AD-A065643; RADC-TR-78-280) Avail: NTIS HC A04/MF A01 CSCL 14/1

Martin Marietta Corporation conducted a 12 month study program to develop models for the evaluation of trade-offs in the requirement to execute specific reliability program elements, the resultant achieved reliability and the impact upon unit production cost. The program elements considered include: Parts standardization, selection and control; vendor selection, qualification and surveillance; and screening and test programs at piece part and various assembly levels. Author (GRA)

N79-24361# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
IMPROVED ULTRASONIC NONDESTRUCTIVE TESTING OF PRESSURE VESSELS Progress Report, 1 Oct. 1977 - 30 Sep. 1978
J. R. Frederick, C. VandenBroek, M. Elzinga, M. Dixon, D. Papworth, N. Hamano, and K. Ganapathy Dec. 1978 171 p refs
(Contract NRC-04-75-182)
(NUREG-CR-0581) Avail: NTIS HC A08/MF A01

Progress in the development of a synthetic aperture focusing technique for ultrasonic pulse-echo flaw evaluation is described. The progress includes improvement in display techniques, initial results of a Spotlight-mode scanning technique, improvement in deconvolution, an assessment of the ability to identify flaw types, and an assessment of the potential for real time synthetic aperture processing ultrasonic data. DOE

N79-24362# National Bureau of Standards, Washington, D. C. National Measurement Lab.
[ACTIVITIES OF THE NATIONAL BUREAU OF STANDARDS NONDESTRUCTIVE EVALUATION PROGRAM FOR FISCAL YEAR 1978: SUMMARY] Final Annual Report, 1978
Harold Berger and Leonard Mordfin Nov. 1978 59 p refs
(PB-291946/2; NBSIR-78-1581) Avail: NTIS HC A03/MF A01 CSCL 14B

The National Bureau of Standards nondestructive evaluation program emphasized activities over the Fiscal Year 1978. However, since this is the program's first annual report, some material was included to emphasize activities since the program was formally instituted in June 1975. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-24363 Connecticut Univ., Storrs.
VIBRATION AND STABILITY OF BEAM REINFORCED POLAR ORTHOTROPIC ANNULAR PLATES OF UNIFORM AND VARIABLE THICKNESS Ph.D. Thesis
Carl Theodore Dyka 1978 79 p
Avail: Univ. Microfilms Order No. 7911363

The natural frequencies and buckling loads for a radially compressed polar orthotropic annular plate (of both uniform and variable thickness) surrounded on its inner and outer boundaries by edge beams of rectangular cross section are determined. The inner and outer edge beams are simply supported and subjected to uniform, radial, compressive loadings. For the uniformly thick plate, the annular plate, edge beam system is spinning at a constant angular velocity. The natural frequencies and buckling loads are determined for both the axisymmetric and higher modes and are found to be functions of the in-plane loads, plate dimensions and rigidities, angular velocity (uniform thickness only), edge beam stiffness, mass and inertia parameters, and the profile of the plate. Dissert. Abstr.

N79-24364 Connecticut Univ., Storrs.
ON THE AXISYMMETRIC CONTACT OF CLOSELY CONFORMING ELASTIC BODIES Ph.D. Thesis
Michael John Hartnett 1978 93 p
Avail: Univ. Microfilms Order No. 7911375

The problem of the axisymmetric contact of conformal elastic bodies is solved using three-dimensional, isotropic, linear elasticity theory. First an expression is derived which governs the mating of opposing surfaces by allowing two degrees of freedom to initially separated points both before and after contact is made. Next, the displacement relationships appropriate for a sphere and an elastic space with a spherical cavity are developed, and subsequently a Fredholm integral equation is derived. A solution is found which not only avoids the geometric simplifications and the half-space assumptions of Hertz's theory, but also permits, by simple extension, the analysis of contact problems whereby the body shapes are substantially different than spherical. A number of numerical studies are made for the case of frictionless contact. Dissert. Abstr.

N79-24365 Texas Univ. at Austin.
EXISTENCE AND APPROXIMATIONS FOR SADDLE-POINT PROBLEMS WITH APPLICATION TO NONLINEAR INCOMPRESSIBLE ELASTICITY Ph.D. Thesis
Ming-Goei Sheu 1978 142 p
Avail: Univ. Microfilms Order No. 7911025

A general mathematical theory for the existence and approximations of solutions of saddle-point problems in the calculus of variations is established and then applied to traction boundary-value problems in nonlinear incompressible elasticity. An existence theorem for solutions of saddle-point problems is given and then modified so as to apply to a class of saddle-point problems constructed by Lagrange multiplier methods for constrained optimization problems. The consistency and stability of Galerkin approximations of this class of saddle-point problems are defined precisely. Mixed finite-element techniques are employed to find the Galerkin approximations of a model boundary-value problem in elastostatics of a specific class of incompressible hyperelastic materials. A priori error estimates are obtained for the mixed finite-element approximations under certain conditions. Dissert. Abstr.

N79-24366 Pennsylvania State Univ., University Park.
LARGE DEFLECTION RESPONSE OF ELASTIC/VISCOPLASTIC BEAMS UNDER COMBINED TENSION AND BENDING Ph.D. Thesis
Suk Jai Yim 1978 206 p
Avail: Univ. Microfilms Order No. 7909151

The prediction of the dynamic responses of elastic/viscoplastic clamped beams between immovable vertical supports subjected to rapid base motion is presented by including the material rate sensitivity. Significant tension, as well as bending was produced in the beam. Large deflections were considered and the finite difference method was used to solve this nonlinear problem. Four different beam materials were examined: (1) cold-rolled 1018 steel; (2) annealed 1018 steel; (3) hot-rolled 1018 steel; and (4) tempered steel. Experiments were carried out to check the validity of the analytical method and to determine the best value of the rate-sensitive parameter in the constitutive equation. The time delay between occurrence of maximum stress and maximum strain in the predicted dynamic stress-strain relation was also examined. Dissert. Abstr.

N79-24367 Oklahoma Univ., Norman.
FRACTURE PREDICTION IN PLANE ELASTO-PLASTIC PROBLEMS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Robert Gary Belie 1978 130 p
Avail: Univ. Microfilms Order No. 7911142

A finite element program based on the plane stress assumption is developed and applied to elasto-plastic fracture problems involving monotonically increasing loads. The program directly predicts the initiation and propagation of fracture in the structure.

That is, the concept of stress intensity factor is not utilized in the present approach. The approach uses a piecewise linear approximation of the actual stress-strain curve for the material, and the maximum strain criteria to predict both the yield and fracture. An incremental loading technique is employed to load the structure, and a zero modulus-unload reload scheme is developed to handle the response of the structure at fracture.
Dissert. Abstr.

N79-24368 Arizona Univ., Tucson.
FINITE ELEMENT ANALYSIS OF ARBITRARY SHELLS Ph.D. Thesis
Donald Liu 1978 193 p
Avail: Univ. Microfilms Order No. 7909482

The work describes the development of a quadrilateral shell finite element having arbitrary surface geometry. The curved surface geometry is based upon the bicubic patch representation popularly employed in free-form surface design. By using piecewise continuous patch assemblages to represent complex surface shapes for finite element stress analysis, an integrated computer--aided surface design and stress analysis tool is thus developed for shell structures. With the computer program, cylindrical and hyperbolic paraboloid shells are generated and structurally analyzed for specified load conditions which are compared with known results Computed and theoretical results are in good agreement, demonstrating the accuracy of the new formulation. Numerical studies are also performed which illustrate the sensitivity of computed results to the accuracy of the underformed geometric representation. Dissert. Abstr.

N79-24369 Engineering Sciences Data Unit, London (England).
CONTACT PHENOMENA. 1: STRESSES, DEFLECTIONS AND CONTACT DIMENSIONS FOR NORMALLY-LOADED UNLUBRICATED ELASTIC COMPONENTS
1978 49 p Also published as ISSN-0141-2590, ISSN-0141-4046 and ISSN-0141-4089
(ESDU-78035; ISBN-0-85679-239-X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 HC E99

The stresses and deflections of contacting bodies are addressed. Data for the contact dimensions, normal approach, delta, surface and sub-surface stresses (for points on the axis of symmetry) together with the depth at which the maximum shear occurs, for dry, normally-loaded elastic bodies are given. Typical applications include civil, structural, machine tool, and automobile engineering, mechanical handling and mining equipment, printing, packaging, and textile machinery, and other fields of engineering involving concentrated contacts. ESDU

N79-24370# National Aerospace Lab., Tokyo (Japan).
COMPARISON OF ACCURACIES OF SOLUTIONS OF LINEAR SHELL THEORIES FOR CLOSED CIRCULAR CYLINDERS UNDER EDGEWISE LOADING
Tatsuzo Koga and Shuji Endo Nov. 1978 24 p refs
(NAL-TR-552T) Avail: NTIS HC A02/MF A01 CSCL 20K

The accuracies of the solutions of the classical linear shell theories are compared for static boundary value problems of edgewise-loaded, circumferentially-closed circular cylindrical shells. Emphasis is placed on the influence of the boundary conditions on the accuracies of the particular solutions. The solutions are obtained accurately within the errors inherent to the Kirchhoff-Love hypothesis for any of those well-known classical theories including the Flugge, the Koiter-Sanders, the Novozhilov, and the Love-Reissner theories. Koiter's conclusions on the accuracy of the equations of the general theory of thin shells are thus reconfirmed. Discussions are made on some of the important characteristics of the solutions as well as on the accuracy of Donnell's approximation. Author

N79-24371# Aeronautical Research Labs., Melbourne (Australia).
RELIABILITY AND STRUCTURAL FATIGUE IN ONE-CRACK MODELS
D. G. Ford Jul. 1978 23 p refs
(ARL-Struc-Rept-369; AR-001-285) Avail: NTIS HC A02/MF A01

Any model of structural fatigue should allow for attrition due to collapse and/or war damage, hijacking, etc. In one-crack structures, attrition adds a single term to the Fokker-Planck equation which statistically describes crack growth. This remarkably simplifies the reliability computation, and elucidates the interaction of fatigue, inspection, ultimate loads and other risks.
Author

N79-24372*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VIBRATION CHARACTERISTICS OF WALLS AND A PLATE GLASS WINDOW REPRESENTATIVE OF THOSE OF A WOOD-FRAME HOUSE
Huey D. Carden May 1979 53 p refs
(NASA-TP-1447; L-12729) Avail: NTIS HC A04/MF A01 CSCL 20K

Mechanical excitation was used, and measurements of acceleration response, natural frequencies, and nodal patterns were performed. Results indicate that the wall sections and the complete wall did not act as a unit in responding to sinusoidal vibration inputs. Calculated frequencies of the components that account for this independent behavior of the studs and face sheets agreeed resonably well with experimental frequencies. Experimental vibrations of the plate glass window agreed with the calculated behavior, and responses of the window exposed to airplane flyover noise were readily correlated with the test results. R.E.S.

N79-24373*# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING OF ELASTOMERS IN ENGINEERING APPLICATIONS. PART 5: ELASTOMER PERFORMANCE LIMITS AND THE DESIGN AND TEST OF AN ELASTOMER DAMPER
J. A. Tecza, M. S. Darlow, and A. J. Smalley Feb. 1979 144 p refs
(Contract NAS3-18546)
(NASA-CR-159552; Rept-79TR30-Pt-5) Avail: NTIS HC A07/MF A01 CSCL 20K

Tests were performed on elastomer specimens of the material polybutadiene to determine the performance limitations imposed by strain, temperature, and frequency. Three specimens were tested: a shear specimen, a compression specimen, and a second compression specimen in which thermocouples were embedded in the elastomer buttons. Stiffness and damping were determined from all tests, and internal temperatures were recorded for the instrumented compression specimen. Measured results are presented together with comparisons between predictions of a thermo-viscoelastic analysis and the measured results. Dampers of polybutadiene and Viton were designed, built, and tested. Vibration measurements were made and sensitivity of vibration to change in unbalance was also determined. Values for log decrement were extracted from the synchronous response curves. Comparisons were made between measured sensitivity to unbalance and log decrement and predicted values for these quantities. R.E.S.

N79-24374# Aeronautical Research Labs., Melbourne (Australia).
SIMPLE FORMULAE FOR CALCULATING THE VIBRATIONAL FREQUENCIES OF PLATES, SHELLS AND MEMBRANES
R. Jones Jun. 1978 16 p refs
(ARL-Struc-Rept-371; AR-001-290) Avail: NTIS HC A02/MF A01

The general form of F = A/W sub max was used with F being the frequency parameter, A being the numerical parameter having a constant value of many different problems, and W sub max being the maximum deflection of an associated static deflection problem. The approach was simple and the agreement between the frequencies calculated using the approximate formulas and those calculated using standard vibration analyses was excellent. R.E.S.

N79-24375# Queens Univ., Belfast (Northern Ireland). Dept. of Aeronautical Engineering.
FLEXURAL VIBRATIONS OF ANNULAR PLATES UNDER UNIFORM INPLANE COMPRESSIVE FORCES
G. K. Ramaiah and P. P. Benham Apr. 1979 21 p refs
Avail: NTIS HC A02/MF A01

The problem of free flexural vibrations of thin annular plates under uniform inplane compressive loads was analyzed by the

Rayleigh-Ritz method for three types of loading conditions, namely: (1) pressure along the inner edge only, (2) equal pressures along both inner and outer edges, and (3) pressure along the outer edge only. Accurate estimates of eigenfrequencies were obtained for axisymmetric, as well as asymmetric modes, for various values of hole sizes and load intensity ratios and for several boundary conditions. It was found that when the flexural mode of vibration coincided with the critical buckling mode of a given annulus, the eigenvalue parameter varied more or less linearly with the load intensity ratio, particularly for the last two loading conditions. For higher modes, unlike the axisymmetric mode, the frequency of plates under internal pressure was observed to increase with increasing values of loads. On the other hand, the frequency decreased with increasing loads for all modes in the other two loading conditions. J.A.M.

N79-24376# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

ON THE OPTIMIZATION OF A STIFFENED SQUARE PANEL UNDER BUCKLING CONSTRAINTS

A. Libai 4 Dec. 1978 45 p refs Backup document for AIAA Synoptic, "Optimization of a Stiffened Square Panel Subjected to Compressive Edge Loads", scheduled for publication in AIAA Journal in Nov. 1979

(Grant AF-AFOSR-3330-77)

(DAS-M-6; Log-J10753) Avail: NTIS HC A03/MF A01

The weight optimization problem was studied for a square plate with a single, eccentric blade-type stiffener subjected to a compressive end load. All three design parameters were varied: plate thickness, stiffener thickness, and stiffener height. The simultaneous buckling configuration for the problem was considered. Two separate optimum configurations were obtained, one of which can be approximated by the fully buckled configuration. F.O.S.

N79-24377# Prototype Development Associates, Inc., Santa Ana, Calif.

APPLICATION OF NITINOL TO HIGH STIFFNESS STRUCTURAL JOINTS Final Report, 20 Feb. 1978 - 20 Feb. 1979

R. D. Brum and J. C. Schutzler Feb. 1979 95 p refs

(Contract N60921-78-C-0049; SF32392501)

(AD-A065561; PDA-TR-1390-00-01) Avail: NTIS HC A05/MF A01 CSCL 13/5

The feasibility of utilizing the unique shape-recovery characteristics of NiTINOL to achieve high preloads in structural joints was demonstrated. High performance missile systems require the shell stiffness in the longitudinal bending mode to be above a critical value to prevent dynamic coupling between the structure and high frequency control systems. In cases where the natural frequency is a limiting design requirement, joint preload greatly affects the design structural weight. NITINOL alloy can be used effectively to preload threaded joints to higher levels than obtainable by applying torque. Several joint concepts utilizing NITINOL were conceived. A NITINOL preloaded threaded joint was designed, analyzed, built, assembled and tested. A NITINOL alloy having a cryogenic transition temperature was used; its compressive recovery characteristics were measured. A method of modeling the recovery characteristics of NITINOL in a general finite-element analysis of the joint was developed. Preload level and joint stiffness were measured for the NITINOL preloaded joint and a conventional, torque preloaded joint of the same design. Results agreed closely with analytical predictions. NITINOL preloading produced significant performance improvements over conventional torque preloaded joints. Author (GRA)

N79-24378# Iowa Univ., Iowa City. Materials Engineering Div.

DYNAMIC STRUCTURAL ANALYSIS WITH SUBSTRUCTURES Interim Technical Report, Sep. - Dec. 1978

Jasbir S. Arora and Duc T. Nguyen Dec. 1978 34 p refs

(Contract DAAK11-77-C-0023)

(AD-A065937; TR-46) Avail: NTIS HC A03/MF A01 CSCL 13/13

A method for dynamic structural analysis with substructures and the subspace iteration is developed. The method does not use component mode synthesis concepts. Therefore eigenproblem for each substructure is not solved. The method uses only substructural stiffness matrices and the mass matrix for each finite element of the system. The mass matrix for the entire structure or any of its substructures need not be computed. However, efficiency of the method is improved when mass matrix for the entire structure is computed and saved in the computer core. Unlike component mode substitution methods, no approximating assumptions are made. Thus, natural frequencies and mode shapes for the finite element model employed are the same with or without the substructuring algorithm. This is demonstrated by computing first ten natural frequencies and the corresponding mode shapes for an open truss helicopter tail-boom structure. Author (GRA)

N79-24379# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

ANALYZE: ANALYSIS OF AEROSPACE STRUCTURES WITH MEMBRANE ELEMENTS Final Report, May - Aug. 1978

Vipperla B. Venkayya and Victoria A. Tischler Dec. 1978 117 p refs

(AD-A065633; AFFDL-TR-78-170) Avail: NTIS HC A06/MF A01 CSCL 13/13

This report contains documentation for the program 'ANALYZE'. The program library consists of a bar, a membrane triangle, a quadrilateral, and a shear panel. The equations of finite element analysis, element formulations, program organization, and subroutine descriptions provide a comprehensive theoretical background for the program. The input and output instructions together with the sample problem and the results should provide adequate information for the use of this program. 'ANALYZE' is an in-house program and can be used on INTERCOM for problems up to 150 to 200 degrees of freedom and a comparable number of elements. This program is extremely useful in training engineers in the use of finite element programs, in the development of finite element models of large aerospace structures, and in research in structural analysis and optimization. Author (GRA)

N79-24380# Defence Research Information Centre, Orpington (England).

BOLTED JOINT FATIGUE PROGRAMME. VOLUME 1. STAGE 1, SECTIONS 1 TO 6

R. H. Sandifer May 1978 167 p refs

(AD-A064080; DRIC-BR-60444-Vol-1; S/T-Memo-1-77-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13/5

The programme consisted of two major parts - a photoelastic investigation into the stress distribution and resulting stress concentration factors in a family of simple bolted joints, and a correlated series of fatigue tests on bolted metal joints having the same geometrical form as the photoelastic ones using a commonly employed aluminum alloy for the plates and a steel in current use for the pins. Author (GRA)

N79-24381# Air Force Academy, Colo. Frank J. Seiler Research Lab.

TEST AND EVALUATION OF SPLIT RING SHEAR CONNECTORS IN LAMINATED WOOD AND LAMINATED WOOD BOLTS Final Report, Sep. 1977 - Sep. 1978

Dwayne D. Piepenburg Mar. 1979 162 p refs

(AD-A066323; FTSRL-TR-79-0002) Avail: NTIS HC A08/MF A01 CSCL 13/5

This paper describes the procedures used to establish the strength of 4 inch diameter beveled TECO split-ring shear connectors in PERMALI laminated wood gusset plate material. Fifty-one specimens were tested with varying combinations of end and edge distances. The effect of surface grain orientation to direction of loading was also investigated. Test data for split-ring shear connectors are presented as load-deformation curves. Ultimate load capacity is shown to be a function of end and edge distance but relatively independent of surface grain orientation to direction of loading. End and edge distances greater than 3.5 inches do not appear to significantly increase the shear strength of the split-ring connector. Laminated wood bolts having a nominal diameter of 3/4 inch were tested under various states of combined stress. Test data is presented in tabular and graphical form. The bolts are shown to behave as a bilinear material with independent ultimate tensile and torsional stresses. The most frequent failure mode was the shearing off of the threads on the wood bolts. After applying a load duration factor for testing

and a factor of safety of 2, allowable design loads of 1600 lb in tension and 9.5 ft-lb in torsion are recommended.
Author (GRA)

N79-24382# Battelle Columbus Labs., Ohio.
CRITICAL EXPERIMENTS, MEASUREMENTS, AND ANALYSES TO ESTABLISH A CRACK ARREST METHODOLOGY FOR NUCLEAR PRESSURE VESSEL STEELS Quarterly Progress Report, Jan. - Mar. 1978
G. T. Hahn, P. C. Gehlen, R. G. Hoagland, J. Lereim, M. W. Kanninen, C. Popelar, C. W. Marschall, and A. R. Rosenfield Dec. 1978 88 p refs
(Contract AT(49-24)-0293)
(NUREG-CR-0583; BMI-2014) Avail: NTIS HC A05/MF A01

Results of a program seeking (1) dynamic analyses of crack arrest in thermally stressed nuclear pressure vessels,(2) standardization of a laboratory test method for measuring the crack arrest toughness, and (3) a crack arrest toughness data base for unirradiated and irradiated nuclear steels and weldments are described. The governing equations are developed for the solution of the problem of the dynamic propagation and arrest of a continuous circumferential crack emanating from the inner surface of a hollow cylinder and advancing through the wall toward the outer surface. Fractographic studies are reported which show that crack arrest toughness values are connected with the fracture appearance, specifically the formation of ligaments, the fibrous (ductile) failure of the ligaments and the amounts of cleavage and fibrous fracture area visible on the surface. Finally, preparations for irradiating crack arrest specimens are described and the dosimetry results obtained from the mockup experiment are analyzed. DOE

N79-24383# Brown Univ., Providence, R. I. Div. of Engineering.
RECENT FINITE ELEMENT STUDIES IN PLASTICITY AND FRACTURE MECHANICS
J. R. Rice, Robert M. McMeeking (Illinois Univ., Urbana), David M. Parks (Yale Univ.), and E. Paul Sorensen (General Motors Research Labs.) Aug. 1978 76 p refs Presented at FENOMECH '78 Conf., Stuttgart, 30 Aug. - 1 Sep. 1978 and Conf. on Nucl. Interactions, Canberra, Australia, 28 Aug. 1978
(Contract EY-76-S-02-3084)
(COO-3084-62; Conf-780854-3) Avail: NTIS HC A05/MF A01

A precise formulation of incremental equilibrium equations and their finite-element forms in a manner valid for deformations of arbitrary magnitude is described. Special features of computational procedures were outlined for accuracy in view of the near-incompressibility of elastic-plastic response. Applications to crack mechanics discussed include the analysis of large plastic deformations at a progressively opening crack tip, the determination of J integral values and of limitations to J characterizations of the intensity of the crack tip field, and the determination of crack tip fields in stable crack growth. DOE

N79-24384# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ELASTIC-PLASTIC TORSION OF PRISMATIC BARS WITH POLYGONAL CROSS SECTION
L. A. Galin [1978] 26 p refs Transl. into ENGLISH from Prikl. Mat. Mekh. (USSR), v. 8, 1944 p 307-322
(Contract EY-76-C-03-0700)
(ETEC-Trans-1) Avail: NTIS HC A03/MF A01

The problem regarding the torsion of prismatic bars with a convex polygonal cross section when the torque is so large that plastic deformation regions emerge in the bar is examined. DOE

N79-24385# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
LOADED SHELLS WITH RIGID MANTELS [TRAGVERHALTEN STARR UNMMANTELTER SCHALEN]
J. H. Argyris, G. A. Malejannakis, and E. Schelke 1978 96 p refs In GERMAN; ENGLISH summary Sponsored by Devt. Forschungsgemeinschaft
(ISD-227) Avail: NTIS HC A05/MF A01

A shell with a rigid mantle was idealized by finite elements. No restriction is made on the shape of the shell, on the stresses nor in the expansion of the contact surface. Partial problems were then considered such as geometric nonlinearity (large displacements), nonconservative load (e.g. hydrostatic pressure), contact problems (shell - rigid mantel), stability problems (with different boundary conditions), and post-buckling behavior (in the rigid mantle). By solving the nonlinear force-displacement relation in the stable region and applying eigenvalue analysis in the unstable region, the equilibrium positions, the contact force distributions, and (if present) the critical loads were analyzed by considering contact conditions. Examples were investigated in which the above problems occur individually or in combination. As a practical application, the buckling load of a plastic pipe lying in a concrete pipe and loaded by underground water was derermined and results are detailed. Author (ESA)

N79-24386# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
INCREMENTAL FORMULATION IN NONLINEAR MECHANICS AND LARGE STRAIN ANALYSIS OF ELASTO-PLASTIC AND ELASTO-VISCOPLASTIC PROBLEMS. NATURAL FINITE ELEMENT APPROACH
J. H. Argyris, J. S. Doltsinis, and M. Kleiber (Polish Acad. of Sci., Warsaw) 1978 50 p refs
(ISD-232) Avail: NTIS HC A03/MF A01

Basic concepts about consistent large strain formulation of elasto-plastic problems were extended and refined in order to develop an incremental natural strain formulation for axisymmetric elastoplasticity. Geometrically nonlinear terms were included. Elastoviscoplastic behavior was analyzed. Some examples were studied such as a thick cyclinder under internal pressure as well as expansion of a hole. Software implementation and computational methods are presented. Author (ESA)

N79-24387# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstructionen.
THERMOMECHANICAL CALCULATIONS FOR MASSIVE STRUCTURES USING A FINITE ELEMENT METHOD [FINITE ELEMENTE ZUR THERMOMECHANISCHEN BERECHNUNG VON MASSIVBAUTEN]
J. H. Argyris, J. Szimmat, and K. J. William Apr. 1978 48 p refs In GERMAN; ENGLISH summary Presented at Meeting on Finite Elements in Construct. Engr., Hanover, 13-14 Apr. 1978
(ISD-234) Avail: NTIS HC A03/MF A01

A finite element method was used to analyze thermal stresses and mechanical deformations in massive structures. Nonstationary temperature fields and inelastic analysis were treated separately. A single integrated software package was developed to study combinad thermal/enelastic behavior. Two reactor vessel applications, thermal shock and long-term characteristics, are presented. Author (ESA)

N79-24388# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
A CLASS OF STRUCTURAL OPTIMIZATION PROBLEMS: OPTIMAL ARCHGRIDS
G. I. N. Rozvany (Monash Univ.) and W. Prager 1978 44 p refs
(ISD-236) Avail: NTIS HC A03/MF A01

The optimization of a curved surface structure consisting of a system of intersecting arches in two prescribed directions is discussed. Optimality conditions were derived for given vertical loads; then the optimal shape of the structure was determined for square, rectangular, and cross-shaped domains. Author (ESA)

N79-24389# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
OPTIMAL BEAM LAYOUTS: ALLOWANCE FOR COST OF SHEAR
G. I. N. Rozvany 1978 23 p refs Sponsored by Australian Res. Grants Comm.
(ISD-237) Avail: NTIS HC A02/MF A01

A modified optimal grillage theory that takes into consideration the effect of shear forces on cost is described. This theory was tested on examples such as clamped corners, square clamped grillages, square simply supported grillages, and triangular simply supported grillages. A computer program for analytically generating optimal beam layouts, the cost of which depend only on bending, was developed. This program will enable more realistic designs to be developed for long-span systems. Author (ESA)

N79-24390# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
INELASTIC RESISTANCE CALCULATIONS WITH TIME DEPENDENT THERMAL AND MECHANICAL STRESS [FESTIGKEITSBERECHNUNGEN BEI INELASTISCHEM VERHALTEN UND ZEITABHAENGIGER THERMISCHER UND MECHANISCHER BELASTUNG]
J. S. Doltsinis and H. Westenberg 1978 37 p refs In GERMAN Sponsored by Bundemin. fuer Forsch. u. Technol.
(ISD-238) Avail: NTIS HC A03/MF A01

The stress behavior of a galvanizing vessel was analyzed during its 255 hr breaking-in period. For this purpose, existing calculation methods and the ASKA program were adapted to the treatment of inelastic nonisothermal behavior with variable time dependent wall conditions. Particular stress states appear in the material as a result of thermal expansion and irreversible effects such as plasticity and creep. The behavior of the supporting structures of the deformed vessel was also analyzed. Force/displacement relations were obtained for each element and for the overall structure. Isostress characteristics are given.
Author (ESA)

N79-24391# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft-und Raumfahrtkonstruktionen.
GEOMETRICALLY NONLINEAR FINITE ELEMENT BEHAVIOR USING BUCKLING MODE SUPERPOSITION
Dennis A. Nagy (Princeton Univ.) 1978 60 p refs
(ISD-241) Avail: NTIS HC A04/MF A01

A comprehensive treatment of linear buckling mode superposition within finite element analysis, including theoretical derivations, physical interpretation, software implementation, computational considerations, and selected application examples is presented. Particular emphasis is placed on explicit interpretation of the assumptions defining the class of problems for which the method applies, physical properties of the resulting behavior, and criteria for confirming the validity of the solution. Examples include a braced truss tower and an asymmetrically loaded arc.
Author (ESA)

N79-24392# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstrucktionen.
ON LARGE DISPLACEMENT-SMALL STRAIN ANALYSIS OF STRUCTURES WITH ROTATIONAL DEGREES OF FREEDOM
J. H. Argyris, P. C. Dunne, G. A. Malejannakis, and D. W. Scharpf (Recnen-u. Entwicklungsinst. fuer EDV im Bauwesen) Aug. 1977 175 p refs
(ISD-247) Avail: NTIS HC A08/MF A01

Semitangential rotation techniques were used to obtain unique strain-displacement relations for large displacement problems involving rotations about orthogonal axes. A geometrically nonlinear theory was used to define appropriate moments and rotations. The natural mode technique was introduced. A consistent derivation of geometrical stiffness matrices was developed from energy principles. Numerical examples are given: lateral buckling of cantilever, lateral buckling of right-angle frame, torsional buckling problems, right-angle frame under end-moments, lateral buckling of right-angle frame with end load and lateral post-buckling behavior of cantilever beam. Author (ESA)

N79-24393# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstrucktionen.
NOTE ON LARGE STRAIN APPLICATIONS OF A MODIFIED CONSTANT STRAIN FINITE ELEMENT METHOD
J. H. Argyris, P. C. Dunne, and M. Mueller Aug. 1977 32 p refs
(ISD-248) Avail: NTIS HC A03/MF A01

An isochoric constant strain finite element analysis was supplemented by studies of modified strain energy density functions. Some numerical examples are given for Mooney materials such as an infinite cylinder with internal expansion under plane strain, an incompressible rectangular membrane, an incompressible square membrane with extension and compression, and a thick cylinder under compression. The corresponding curves are presented. Author (ESA)

N79-24394# Montpellier Univ. (France). Lab. de Physique Mathematique.
SPECTRAL AND SCATTERING INVERSE PROBLEMS [PROBLEME INVERSE DES MODES NORMAUX D'UNE SPHERE ELASTIQUE]
P. C. Sabatier Jan. 1978 8 p refs In FRENCH; ENGLISH summary
(PM/78/1) Avail: NTIS HC A02/MF A01

The inverse problem for an elastic sphere with rho and lambda depending on R, but mu = 0, was studied (R = radius; rho = density; lambda and mu are Lame parameters). Results show that the functions lambda(R) and rho(R) can be determined if both are differentiable twice, knowing the values of lambda and rho at the surface and the mode spectra corresponding to two values of L. Results are useful for seismic wave analysis.
Author (ESA)

N79-24395# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).
FLIGHT-BY-FLIGHT CRACK PROPAGATION TEST RESULTS WITH SEVERAL LOAD SPECTRA AND COMPARISON WITH CALCULATION ACCORDING TO DIFFERENT MODELS
K. O. Sippel and D. Weisgerber 12 May 1977 43 p refs Presented at ICAF Symp., Darmstadt, West Ger., 12 May 1977 Sponsored by Ger. Min. of Defence
Avail: NTIS HC A03/MF A01

Tests were carried out with various widely differing spectra on 7075T7351 and Ti6Al4V alloys on on HP 9-4-30 and 300M steels. The results obtained with the Forum crack propagation model and the retardation models of Wheeler, Willenborg, and Habilie were compared with real behavior in order to determine the validity of these models. None of the models could predict crack propagation behavior under all circumstances. The Forman model, when properly applied, seemed to be the best for making rough estimates. The retardation models were completely unsuitable for calculations using load cycles with considerable 1g flight stress variations. Author (ESA)

N79-24396# Oxford Univ. (England). Engineering Lab.
A VARIATIONAL SOLUTION OF THE FRICTIONAL UNLOADING PROBLEM
John Rodney Turner 1977 31 p refs
(OUEL-1212/77) Avail: NTIS HC A03/MF A01

A stress analysis problem was studied in which nonlinearity enters through frictional boundary conditions. A variational formulation was obtained for the problem of loading and unloading a linear elastic half-space by a rigid circular cylindrical punch, when conditions of Coulomb friction act over the interface throughout. A numerical solution was obtained using the finite-element technique. By limiting the surface stresses to a finite-dimensional subspace, a quadratic minimization is reduced to matrix form without further approximation. This gives a quadratic programming problem, which is solved using the quadratic simplex algorithm. The surface radial stress distribution is obtained for the discrete solution, giving information about the expected fracture of brittle materials on loading and unloading. Author (ESA)

N79-24397# Oxford Univ. (England). Engineering Lab.
THE BOUSSINESQ AND CERRUTI SOLUTIONS FOR A TRANSVERSLY ISOTROPIC HALF-SPACE
J. R. Turner 1978 20 p refs
(OUEL-1232/78) Avail: NTIS HC A02/MF A01

The potential function solution for stress states in a transversely-isotropic (hexagonally aeolotropic) material is rederived. Results confirm that if this problem is expressed in terms of the engine components of the elasticity tensor the resulting expressions take a simpler form than those previously obtained. These potential solutions were used to obtain stress fields of the Neuber-Papkovitch type, that is, ones in which the only non-zero surface stress component is either the normal component or shear component in one of two perpendicular directions on a half-space with normal in the preferred direction. Finally, the surface displacement resulting from an arbitrary point load acting on the surface is obtained from the potential corresponding to a point load. Author (ESA)

N79-24398# Oxford Univ. (England). Engineering Lab.
OPTIMUM PLASTIC DESIGN OF A VARIABLE-THICKNESS ORTHOTROPIC PLATE UNDER IN-PLANE LOADING

T. R. Tauchert and W. S. Hemp 1978 24 p refs
(OUEL-1237/78) Avail: NTIS HC A02/MF A01

Using Hill's criterion for yielding of an orthotropic material, the plastic design of a plate having minimum volume was investigated. A stress-function approach is proposed for finding an approximate solution to the nonlinear optimization problem. The possibility of using piecewise linear representations of the yield surface in order to reduce the problem to a linear one was also explored. Numerical results are presented for a circular plate under axisymmetric loading, and it is demonstrated that solutions to the linearized problems provide bounds upon the volume of material required by the Hill condition. Author (ESA)

N79-24399# Oxford Univ. (England). Engineering Lab.
GENERALISED DISPLACEMENT FUNCTIONS
John D. Renton 1978 18 p refs
(OUEL-1244/78) Avail: NTIS HC A02/MF A01

The governing differential equations for an elastic continuum derived by Novozhilov and Bolotin are examined. It is shown that potential functions can be derived from these equations which, when the initial stresses are uniform, can be regarded as the components of a generlaized Galerkin vector. An alternative representation of the displacement vector is given which is not limited to the case of uniform initial stress and is in some cases more convenient to use than the Galerkin vector. The application of the analysis is illustrated by an exact treatment of the buckling of a solid circular rod. Author (ESA)

N79-24400# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
DETERMINATION OF THE FATIGUE STRENGTH OF WELDED JOINTS ON AlZnMg 1 BASED ON LOCAL STRAIN MEASUREMENTS, VOLUME 1
E. Hailbach and H. G. Koebler 1978 65 p refs In GERMAN; ENGLISH summary 2 Vol.
(LBF-TB-111-Vol-1) Avail: NTIS HC A04/MF A01

The local strains occuring in material areas critical to fatigue were directly measured by means of strain gages and compared with allowable values particularly determined in order to check the dimensioning of fatigue loaded welded joints experimentally. Bending tests carried out on three types of fillet welded joints differing in the loading of the throat section were used. The specimens were produced by manual or automatic welding. Referring to previous research carried out on welded joints in structural steel the applicability of this procedure to welded joints in AlznMg 1 was investigated. Results confirm, almost independent of the type of joint, a statistical correlation between the measured local strain amplitudes and the endurance in number of cycles to a failure, provided the fatigue crack originates at the weld toe. Author (ESA)

N79-24401# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
DETERMINATION OF THE FATIGUE STRENGTH OF WELDED JOINTS ON AlZnMg 1 BASED ON LOCAL STRAIN MEASUREMENTS, VOLUME 2
H. G. Koebler Aug. 1978 79 p refs In GERMAN; ENGLISH summary 2 Vol.
(LFB-TB-112-Vol-2) Avail: NTIS HC A05/MF A01

Based on the local strains measured at the critical weld toe by means of strain gages, fatigue test series on fillet welded joints of the aluminum alloy AlZnMg 1 and the influence of the type of loading and of the stress ratio or mean stress on fatigue life was investigated. The test results show significant differences in fatigue life between alternating and zero tension loading, which means a high mean stress sensitivity. The fatigue strength in terms of the local strain amplitudes shows less variation among the different types of joints than the fatigue strength in terms of the nominal strain amplitudes. This confirms that the fatigue behavior of fillet welded joints in AlZnMg 1 is more uniformly describable by means of local strain amplitudes than by means of nominal strain amplitudes. Author (ESA)

N79-24402# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A METHOD FOR DERIVING STATISTICAL PARAMETERS FOR DESIGN AGAINST RANDOM STRESSES RESULTING FROM WORKING OPERATIONS
J. M. Zaschel Apr. 1978 110 p refs In GERMAN; ENGLISH summary
(LFB-FB-135) Avail: NTIS HC A06/MF A01

To improve design against fatigue, load-time histories were studied both for working loads and environmental loads. The sequence in time of load fluctuations as well as their magnitude and number of occurrences were considered. The description of working loads is based on the theory of discontinuous stochastic processes since they mostly occur as sporadic events. Working segments have been defined which are charaterized by their arrival time, duration, and content. Results show that the arrival time is fitted well by the Poisson distribution and the duration by the Gamma distribution. Examples are drawn from load-time histories measured on a car, a truck, an airplane, and a rolling mill. Author (ESA)

N79-24403# National Technical Information Service, Springfield, Va.
STRESS CRACK PHENOMENA VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Feb. 1977 - Jan. 1978
Guy E. Habercom, Jr. Apr. 1979 175 p
(NTIS/PS-79/0269/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Stress analyses of various materials in which cracks are generated have been investigated in these reports. Stress corrosion, fracture mechanics, and crack propagation are also researched. Mathematical models and computer programs have been excluded from these reports. (This updated bibliography contains 167 abstracts, none of which are new entries to the previous edition.) GRA

N79-24404# National Technical Information Service, Springfield, Va.
STRESS CRACK PHENOMENA VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Feb. 1978 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 207 p Supersedes NTIS/PS-78/0149; NTIS/PS-77/0062
(NTIS/PS-79/0270/3; NTIS/PS-78/0149; NTIS/PS-77/0062) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Stress analyses of various materials in which cracks are generated have been investigated in these reports. Stress corrosion, fracture mechanics, and crack propagation are also researched. Mathematical models, rock mechanics, and computer programs have been excluded from these reports. (This updated bibliography contains 198 abstracts, all of which are new entries to the previous edition.) GRA

N79-24405# Battelle Columbus Labs., Ohio.
CRITICAL EXPERIMENTS, MEASUREMENTS AND ANALYSES TO ESTABLISH A CRACK ARREST METHODOLOGY FOR NUCLEAR PRESSURE VESSEL STEELS Quarterly Report, Oct. - Dec. 1977
G. T. Hahn, P. C. Gehlen, R. G. Hoagland, M. F. Kanninen, and C. W. Marschall Dec. 1978 71 p refs
(Contract AT(49-24)-0293)
(PB-291190/7; BMI-2010; NUREG-CR-0518) Avail: NTIS HC A04/MF A01 CSCL 11J

Results of a program seeking (1) dynamic analyses of crack arrest in thermally stress nuclear pressure vessels; (2) standardization of a laboratory test method for measuring the crack arrest toughness; and (3) a crack arrest toughness data base for unirradiated and irradiated nuclear steels and welments are described. Dynamic finite difference analyses of fast fracture and arrest of an axial, part-through crack in a thick walled cylinder are refined and applied to the experiment. The influences of the mesh size and aspect ratio on the static stress intensity values are examined and the results compared with finite element calculations. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-24406 Cornell Univ., Ithaca, N. Y.
A SYSTEMS PROCEDURE FOR LAND USE AND WATER QUALITY PLANNING IN A RURAL WATERSHED Ph.D. Thesis
Wen-Taur Thomas Tseng 1979 381 p
Avail: Univ. Microfilms Order No. 7910783

A two-stage systems procedure was developed for aiding land use and water quality planning in a rural watershed where non point sources of pollution may have a significant impact on water quality. The first stage of the systems procedure is a linear programming model which generates land use plans for an improved level of management based on the Soil Conservation Service's recommendations of land uses and cropping systems suitable for different land capability units. The second stage of the systems procedure is a digital computer simulation model, developed on the framework of the USDAHL-74 Revised Model of Watershed Hydrology, for estimating streamflow and inorganic nitrogen loadings. The optimun land use plans generated in the first stage are examined in detail in the second stage using the simulation model. Dissert. Abstr.

N79-24407 Texas A&M Univ., College Station.
EVALUATION OF LANDSAT MSS DATA FOR CLASSIFYING AND CHARACTERIZING NATURAL VEGETATION ON A REGIONAL BASIS Ph.D. Thesis
Kirk Cole McDaniel 1978 200 p
Avail: Univ. Microfilms Order No. 7909220

Landsat imagery was used to map and classify natural vegetation throughout northcentral Texas and southcentral Oklahoma. Computer compatible Landsat digital data were analyzed to determine the relationship between spectral reflectance and different vegetation parameters measured on the ground. Three contributions in remote sensing of natural vegetation from satellite data products are (1) a natural vegetation classification suitable for remote sensing use, (2) the evaluation of different dates of imagery for relative information content, and (3) information relating LANDSAT multispectral scanner digital data to quantitative vegetation measurements. Results provide guidelines for employing a Landsat image/data analysis approach to be used in natural resource management programs. The results are particularly appropriate for use and application in regional vegetation survey programs. Dissert. Abstr.

N79-24408 Pennsylvania State Univ., University Park.
EVALUATION OF FLOW PROPERTIES OF DILUTE AQUEOUS POLYMER SOLUTIONS FOR ENHANCED OIL RECOVERY APPLICATIONS Ph.D. Thesis
Esref Uensal 1978 362 p
Avail: Univ. Microfilms Order No. 7909143

The properties of the solutions of xanthan gum, sodium cellulose sulfate esters, polyacrylamides, and hydroxy ethyl cellulose and the injectabilities of these solutions into porous media were investigated. Xanthan gum solutions require orifice mixing and filtration in order to have good flow properties through porous media. The solution properties of sodium cellulose sulfate esters were similar to those of xanthan gum. The solution properties of Polyacrylamides were extremely sensitive to the system variables. Because of the intermolecular associations, these polymers could not be filtered effectively or injected into fine porous media. Solutions of hydroxy ethyl compounds were insensitive to system variables. They could not be injected into fine porous media because of the high concentrations required for mobility control purposes. Dissert. Abstr.

N79-24409 Texas Univ. at Austin.
AUTOMATIC HISTORY MATCHING OF GEOPRESSURED-GEOTHERMAL RESERVOIR PERFORMANCE DATA BY USE OF OPTIMAL CONTROL THEORY Ph.D. Thesis
Rufus Oladipo Elemo 1978 344 p
Avail: Univ. Microfilms Order No. 7910956

Three of the pertinent parameters of stress-sensitive, geopressured-geothermal reservoir systems were singly and jointly (different combinations of two parameters and the three parameters) estimated. The method of History Matching was applied. In History Matching, mathematical programming methods are used to optimize a criterion function which is a mathematical formula that characterizes the difference between the calculated model behavior and the observed behavior of the real physical system. Numerically controlled experiments indicated that the temporal response of geopressured-geothermal reservoirs pressure is sensitive to permeability, uniaxial compaction coefficient, net pay thickness, specific productivity index and, in a much less degree, to porosity. Based on these results, stress-sensitivity permeability (distributions in homogeneous and heterogeneous reservoirs), uniaxial compaction coefficient and porosity were considered for estimation. Dissert. Abstr.

N79-24410*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
STRATIFICATION AND SAMPLE SELECTION FOR MULTICROP EXPERIMENTS
D. A. Landgrebe, Principal Investigator, M. M. Hixson, B. J. Davis, and M. E. Bauer Nov. 1978 53 p EREP
(Contract NAS9-15466)
(E79-10190; NASA-CR-160154; LARS-CR-112278) Avail: NTIS HC A04/MF A01 CSCL 02C

The author has identified the following significant results. A stratification was performed and sample segments were selected for an initial investigation of multicrop problems in order to support development and evaluation of procedures for using LACIE and other technologies for the classification of corn and soybeans, to identify factors likely to affect classification performance, and to evaluate problems encountered and techniques which are applicable to the crop estimation problem in foreign countries. Two types of samples, low density and high density, supporting these requirements were selected as research data set for an initial evaluation of technical issues. Looking at the geographic location of the strata, the system appears to be logical and the various segments seem to represent different conditions. This result is supportive not only of the variables and the methodology employed in the stratification, but also of the validity of the data sets employed.

N79-24411*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 8, GRAYS HARBOR COUNTY, WASHINGTON Final Report
J. C. Prill, Principal Investigator Mar. 1979 95 p refs Sponsored in part by US Forest Service Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15800)
(E79-10191; NASA-CR-160152; LEC-12911; JSC-14777)
Avail: NTIS HC A05/MF A01 CSCL 13B

The author has identified the following significant results. Level 2 forest features (softwood, hardwood, clear-cut, and water) can be classified with an overall accuracy of 71.6 percent plus or minus 6.7 percent at the 90 percent confidence level for the particular data and conditions existing at the time of the study. Signatures derived from training fields taken from only 10 percent of the site are not sufficient to adequately classify the site. The level 3 softwood age group classification appears reasonable, although no statistical evaluation was performed.

N79-24412*# Stanford Univ., Calif. School of Earth Sciences.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC

STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator Apr. 1979 2 p ERTS
(Contract NAS5-24479)
(E79-10192; NASA-CR-158483) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N79-24413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN OVERVIEW OF THE LARGE AREA CROP INVENTORY EXPERIMENT AND THE OUTLOOK FOR A SATELLITE CROP INVENTORY
R. Bryan Erb, Principal Investigator Mar. 1979 14 p Presented at 1st Brazilian Remote Sensing Symp., Sao Jose Dos Campos, Brazil, 27-29 Nov. 1978 Sponsored by NASA, NOAA, and USDA EREP
(E79-10193; NASA-TM-80431; JSC-13761) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The most important LACIE finding was that the technology worked very well in estimating wheat production in important geographic locations. Based on working through the many successes and shortcomings of LACIE, it can be stated with confidence that: (1) the current technology can successfully monitor what production in regions having similar characteristics to those of the U.S.S.R. wheat areas and the U.S. hard red winter wheat areas; (2) with additional applied research, significant improvements in capabilities to monitor wheat in these and other important production regions can be expected in the near future; (3) the remote sensing and weather effects modeling technology approached used by LACIE is generally applicable to other major crops and crop-producing regions of the world; and (4) with suitable effort, this technology can now advance rapidly and could be widespread use in the late 1980's.

N79-24414*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). METHODOLOGY FOR AREA, YIELD AND PRODUCTION ESTIMATION, RESULTS AND PERSPECTIVE
R. Bryan Erb, Principal Investigator 1977 14 p refs Presented at Advanced Seminar on Remote Sensing Applications in Agriculture and Hydrology, Ispra, Italy, 21 Nov. - 2 Dec. 1977 Sponsored by NASA, NOAA, and USDA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E79-10194; NASA-CR-158485; JSC-13760) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-24415*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979
D. A. Landgrebe 28 Feb 1979 65 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15466)
(E79-10195; NASA-CR-160143; LARS-CR-022879) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-24416*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). DEVELOPMENT OF PROCEDURE M FOR MULTICROP INVENTORY, WITH TESTS OF A SPRING-WHEAT CONFIGURATION Final Report, 15 May 1977 - 14 Nov. 1978
Robert Horvath, Principal Investigator, R. Cicone, E. Crist, R. Kauth, P. Lambeck, W. Malila, and W. Richardson Mar. 1979 142 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15476)
(E79-10197; NASA-CR-160140; ERIM-132400-16-F) Avail: NTIS HC A07/MF A01 CSCL 02C

The author has identified the following significant results. An outgrowth of research and development activities in support of LACIE was a multicrop area estimation procedure, Procedure M. This procedure was a flexible, modular system that could be operated within the LACIE framework. Its distinctive features were refined preprocessing (including spatially varying correction for atmospheric haze), definition of field like spatial features for labeling, spectral stratification, and unbiased selection of samples to label and crop area estimation without conventional maximum likelihood classification.

N79-24417*# Shaker Research Corp., Ballston Lake, N. Y.
DEVELOPMENT OF SENSITIZED PICK COAL INTERFACE DETECTOR SYSTEM Final Report
R. F. Burchill 1979 67 p
(Contract NAS8-32538)
(NASA-CR-161225) Avail: NTIS HC A04/MF A01 CSCL 08I

One approach for detection of the coal interface is measurement of the pick cutting hoads and shock through the use of pick strain gage load cells and accelerometers. The cutting drum of a long wall mining machine contains a number of cutting picks. In order to measure pick loads and shocks, one pick was instrumented and telementry used to transmit the signals from the drum to an instrument-type tape recorder. A data system using FM telemetry was designed to transfer cutting bit load and shock information from the drum of a longwall shearer coal mining machine to a chassis mounted data recorder. G.Y.

N79-24418*# South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
FEASIBILITY OF REMOTE SENSING BENTHIC MICROALGAE Final Report
Richard G. Zingmark [1979] 36 p refs
(Grant NsG-1523)
(NASA-CR-158618) Avail: NTIS HC A03/MF A01 CSCL 08A

Results of data analyses from multispectral scanning data are presented. The data was collected in July 1977 for concentration of chlorophyll in benthic microalgae (mainly diatoms) on an estuary mudflat. G.Y.

N79-24419*# Mitre Corp., McLean, Va.
MICROWAVE REMOTE SENSING LABORATORY DESIGN
E. Friedman Mar. 1979 83 p refs Sponsored by NASA
(Contract F19628-78-C-0001)
(NASA-CR-159015; MTR-7975) Avail: NTIS HC A05/MF A01 CSCL 14B

Application of active and passive microwave remote sensing to the study of ocean pollution is discussed. Previous research efforts, both in the field and in the laboratory were surveyed to derive guidance for the design of a laboratory program of research. The essential issues include: choice of radar or radiometry as the observational technique; choice of laboratory or field as the research site; choice of operating frequency; tank sizes and material; techniques for wave generation and appropriate wavelength spectrum; methods for controlling and disposing of pollutants used in the research; and pollutants other than oil which could or should be studied. R.E.S.

N79-24420*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM Final Report
J. L. Kitzis and S. N. Kitzis 25 May 1979 95 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158674; JPL-9950-85) Avail: NTIS HC A05/MF A01 CSCL 20N

The brightness temperature data produced by the SMMR final Antenna Pattern Correction (APC) algorithm is discussed. The algorithm consisted of: (1) a direct comparison of the outputs of the final and interim APC algorithms; and (2) an analysis of a possible relationship between observed cross track gradients

in the interim brightness temperatures and the asymmetry in the antenna temperature data. Results indicate a bias between the brightness temperature produced by the final and interim APC algorithm. S.E.S.

N79-24421*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A HYDROLOGICAL ANALYSIS OF EAST AUSTRALIAN FLOODS USING NIMBUS 5 ELECTRICALLY SCANNING MICROWAVE RADIOMETER DATA
Lewis J. Allison, Thomas J. Schmugge, and Gavin Byrne (Commonwealth Scientific and Industrial Research Organization, Australia) Mar. 1979 48 p refs Submitted for publication
(NASA-TM-79689) Avail: NTIS HC A03/MF A01 CSCL 08H

A chronology of a major Australian flood in 1974 is presented using Nimbus 5 Passive Microwave Data (ESMR) and other conventional and satellite supporting data. L.S.

N79-24422# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THE OPERATIONAL APPROACH TO PHYSICAL GEODESY Interim Report
Helmut Moritz Oct. 1978 68 p refs
(Contract F19628-76-C-0010)
(AD-A063887; DGS-277; AFGL-TR-78-0281; SR-21) Avail: NTIS HC A04/MF A01 CSCL 08/5

The operational approach to physical geodesy starts from the measurements and asks how they can be used in the best way to determine the earth's figure and gravitational field. All measurements can be represented as nonlinear functionals of the potential and of systematic parameters such as station coordinates. After linearization we obtain an improperly posed problem, to which three standard methods of solving such problems are applied: a change in the solution space, a variational principle according to Tichonov, and a statistical approach. All three approaches seem to converge on collocation with kernel functions and least-squares collocation. Some alternatives are also discussed. Author (GRA)

N79-24423# City of Desert Hot Springs, Calif.
SELF-STARTING MANUAL FOR DIRECT USE APPLICATIONS OF GEOTHERMAL RESOURCES Final Report
Chris C. Christiansen Jul. 1978 129 p refs Sponsored in part by California Energy Commission
(Contract EY-77-C-03-1329)
(PB-290872/1; CAEC-25; SAN-1329-5) Avail: NTIS HC A07/MF A01 CSCL 08I

Communities located near geothermal resources and interested in nonelectric uses of this energy can refer to the Self-Start Manual for aid when evaluating and beginning possible programs. Knowledge gained from programs begun in Desert Hot Springs, California, is presented, including the problems and options associated with exploration of the geothermal area, environmental reports, permits, siting and technology. The steps necessary to achieve full use of geothermal resources, from measuring the extent of the geothermal area to screening project applications, are discussed. Financing options were investigated. GRA

N79-24424# Oregon State Univ., Corvallis.
GEOGRAPHICAL INFORMATION SYSTEMS: A REVIEW Environmental Impact Assessment Project
Kris Brooks May 1978 60 p refs Sponsored in part by Agriculture Dept.
(PB-290748/3; SR-517) Avail: NTIS HC A04/MF A01 CSCL 08F

A geographic information system is a computerized system designed to store, process, and analyze spatial data. Four sections comprise the report: (1) a description of the characteristics of geographic information systems; (2) profiles of geographic information systems; (3) annotated bibliography of geographic system surveys; and (4) a glossary. GRA

N79-24425# Hawaii Univ., Honolulu.
STREAM CHANNEL MODIFICATION IN HAWAII, PART A: STATEWIDE INVENTORY OF STREAMS, HABITAT FACTORS AND ASSOCIATED BIOTA Final Report, Aug. 1975 - Sep. 1976
A. S. Timbol and J. A. Maciolek Apr. 1978 173 p refs
(Contract DI-14-16-0008-1199)
(PB-290571/9; FWS/OBS-78/16) Avail: NTIS HC A08/MF A01 CSCL 13B

A state wide, exhaustive inventory of perennial streams with channel modifications, including a general survey of habitat factors and macrofauna, showed that there are at least 366 perennial streams in the five largest islands of Hawaii. Fifteen percent of these streams were altered. The comparative abundances of these are: lined channel, 40%; realigned/cleared, 28%; revetment, 24%; filled-in channel, 5%; elevated culvert, 3%; and extended culvert, 1%. Eighty-nine percent of the total length of lined channel is located on Oahu. On the basis of other human disturbances, only 14% of Hawaiian streams may be physically pristine, and none of these physically pristine streams is on Oahu. Only 27% are of high ecological quality (pristine-preservation use). Water is exported from 53% of all perennial Hawaiian Streams. Twenty-five species of fish and decapod crustaceans were collected statewide. GRA

N79-24426# New Mexico State Univ., Las Cruces.
RECHARGE AND GROUND WATER CONDITIONS IN THE WESTERN REGION OF THE ROSWELL BASIN Technical Completion Report
Christopher J. Duffy (N. Mex. Inst. of Mining and Technol.), Lynn W. Gelhar (N. Mex. Inst. of Mining and Technol.), and Gerardo Wolfgang Gross (N. Mex. Inst. of Mining and Technol.) Dec. 1978 128 p refs
(Contract DI-14-34-0001-6032; OWRT Proj. A-055-NMEX(1))
(PB-290577/6; WRRI-100; W79-03663) Avail: NTIS HC A07/MF A01 CSCL 13B

Recharge mechanisms are proposed on the basis of several long record observation wells. Water levels with long trends are associated with recharge from areal precipitation. It is thought that several years of above average rainfall are necessary to increase groundwater storage significantly. A fluctuating cyclic response is associated with channel leakage from streams in the study area. This recharge mechanism was verified using a stochastic stream-aquifier model applied to the Rio Hondo and Rio Penasco drainages. With this model, channel leakage and aquifier parameters could be estimated. The two types of water level response are associated with characteristic tritium levels. High tritium levels in wells near streams verify a fast recharge component indicated by the model. For wells not located near streams in the intake area and for wells in the Principal Aquifer, low tritium values are found. GRA

N79-24427# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Civil and Environmental Engineering.
METHODOLOGIES OF EXAMINING POLLUTION FROM URBAN RUNOFF M.S. Thesis
James M. DiLouis Oct. 1978 132 p refs
(Contracts DI-14-34-0001-5128; DI-14-34-0001-7124; OWRT Proj. A-046-NJ(3))
(PB-290595/8; W79-03689) Avail: NTIS HC A07/MF A01 CSCL 13B

Data on runoff, the number of days since the last signficant rainfall, and rainfall intensity are examined. Sampling sites were located in North Philadelphia, Pennsylvania; and Trenton, Hamilton Township and East Windsor in New Jersey. Pollution parameters of concern were limited to nitrate expressed as nitrogen, suspended solids, chemical oxygen demand five-day BOD, total phosphates expressed as total phosphorus, and ammonia expressed as nitrogen. Over a period of four months twenty-eight storm events were sampled. Some positive correlation between the pollutant loadings and the amount of runoff was seen. However, the correlation was different for each site. GRA

N79-24428# Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
DUAL PURPOSE DETENTION BASINS AND SURVEILLANCE PROCEDURES IN URBANIZING WATERSHEDS Final Technical Completion Report
William Whipple, Jr. and Alan W. McIntosh Jan. 1979 33 p refs
(Contract DI-14-34-0001-9032; OWRT Proj. A-048-NJ(6))
(PB-290989/3; W79-04077) Avail: NTIS HC A03/MF A01 CSCL 13B

The use of detention basins for reducing particulate pollution

as well as flood retardation is considered along with a system of surveillance for problem evaluation in small urbanizing streams. Small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanized areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood control effectiveness is entailed by the modification, and the dual purpose basins are more useful in aid of flood control further downstream than the single purpose locally-oriented structures. Runoff pollution from urbanizing areas is important to water quality planning, and occurs largely in particulate form. Tentative criteria for interim use are suggested. GRA

N79-24429# Colorado State Univ., Fort Collins. Dept. of Economics.
CONJUNCTIVE GROUND AND SURFACE WATER ALLOCATIONS: THE ECONOMICS OF A QUASI-MARKET SOLUTION M.S. Thesis
John Daubert 1978 194 p refs
(Contract DI-14-31-0001-4067)
(PB-290992/7; W79-04078; OWRT-B-109-COLO(8)) Avail: NTIS HC A09/MF A01 CSCL 13B

The net farm benefits and corresponding ground and surface water allocation were calculated under an augmentation plan; an unrestricted pumping policy; a system which prevents pumping; and pumping quotas. Any change from the historical open access policy generates a gain to surface water right owners, a loss to those who must curtail their pumping, and an administrative cost. The goal is to determine the water resource policy that maximizes the net social benefits. A computer simulation model incorporating the legal, hydrologic and economic characteristics of the lower South Platte River Basin in Colorado evaluates the policies. Comparing the simulation results of a policy which prohibits pumping and an open access policy indicates that groundwater withdrawals are responsible for much of the area net income. Unrestricted groundwater use increases the predicted net benefits from $11.3 to 33.1 million. GRA

N79-24430# National Technical Information Service, Springfield, Va.
INSTRUMENTATION AND DATA PROCESSING USED IN EARTH RESOURCES TECHNOLOGY SATELLITES (ERTS), VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - 1978
Audrey S. Hundemann Mar. 1979 208 p Supersedes NTIS/PS-78/0070; NTIS/PS-77/0081; NTIS/PS-76/0055; NTIS/PS-75/105
(NTIS/PS-79/0206/7; NTIS/PS-78/0070; NTIS/PS-77/0081; NTIS/PS-76/0070; NTIS/PS-76/0055; NTIS/PS-75/105) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

New or improved remote sensing techniques are given. Topic areas covered include pattern recognition, spectrum analysis, image enhancement, photointerpretation, multispectral photography, and mapping. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-24431* National Aeronautics and Space Administration. Pasadena Office, Calif.
BONDING MACHINE FOR FORMING A SOLAR ARRAY STRIP Patent
Ernest N. Costogue (JPL), Roy G. Downing (JPL), Orwin Middleton (JPL), Robert L. Mueller (JPL), Robert K. Yasui (JPL), Fred J. Cairo (JPL), and Jerry K. Person, inventors (to NASA) (JPL) Issued 17 Apr. 1979 13 p Filed 4 Nov. 1977 Supersedes N78-13441 (16 - 04, p 0482) Sponsored by NASA
(NASA-Case-NPO-13652-2; US-Patent-4,149,665; US-Patent-Appl-SN-848794; US-Patent-Class-228-5.1; US-Patent-Class-228-6; US-Patent-Class-29-572; US-Patent-Class-29-57-4; US-Patent-Class-29-739; US-Patent-Class-29-809) Avail: US Patent and Trademark Office CSCL 10A

A machine is described for attaching solar cells to a flexable substrate on which printed circuitry has been deposited. The strip is fed through: (1) a station in which solar cells are elevated into engagement with solder pads for the printed circuitry and thereafter heated by an infrared lamp; (2) a station at which flux and solder residue is removed; (3) a station at which electrical performance of the soldered cells is determined; (4) a station at which an encapsulating resin is deposited on the cells; (5) a station at which the encapsulated solar cells are examined for electrical performance; and (6) a final station at which the resulting array is wound on a takeup drum.

Official Gazette of the U.S. Patent and Trademark Office

N79-24432* National Aeronautics and Space Administration. Pasadena Office, Calif.
PRIMARY REFLECTOR FOR SOLAR ENERGY COLLECTION SYSTEMS AND METHOD OF MAKING SAME Patent
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Issued 17 Apr. 1979 9 p Filed 25 Jan. 1977 Supersedes N77-20566 (15 - 11, p 1473) Division of US Patent Appl-SN-598969, filed 24 Jul. 1975, US Patent-4,065,053 Sponsored by NASA
(NASA-Case-NPO-13579-3; US-Patent-4,149,817; US-Patent-Appl-SN-762363; US-Patent-Class-405-229; US-Patent-Class-126-270; US-Patent-Class-264-1; US-Patent-Class-264-33; US-Patent-Class-264-34; US-Patent-Class-264-35; US-Patent-Class-264-70; US-Patent-Class-264-71; US-Patent-Class-264-510; US-Patent-Class-264-516; US-Patent-Class-350-292; US-Patent-Class-350-294; US-Patent-Class-350-296; US-Patent-Class-405-263; US-Patent-4,065,053; US-Patent-Appl-SN-598969) Avail: US Patent and Trademark Office CSCL 10A

Solar energy is reflected to a movably supported collector that is kept at the concentrated line focus of the reflector primary by a fixed, linear, ground-based primary reflector having an extended curved sawtooth contoured surface covered with a metalized polymeric reflecting material. The primary reflector was constructed by a process utilizing well-known freeway paving machinery.

Official Gazette of the U.S. Patent and Trademark Office

N79-24433* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR ENERGY COLLECTION SYSTEM Patent
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Issued 17 Apr. 1979 27 p Filed 25 Jan. 1977 Supersedes N77-20565 (15 - 11, p 1473) Division of US Patent Appl. SN-598969, filed 24 Jul. 1975, US Patent-4,065,053 Sponsored by NASA
(NASA-Case-NPO-13579-2; US-Patent-4,149,521; US-Patent-Appl-SN-762362; US-Patent-Class-126-271; US-Patent-Class-237-1A; US-Patent-Class-350-288; US-Patent-Class-350-299; US-Patent-Class-126-400; US-Patent-4,065,053; US-Patent-Appl-SN-598969) Avail: US Patent and Trademark Office CSCL 10A

A fixed, linear, ground-based primary reflector having an extended curved sawtooth-contoured surface covered with a metalized polymeric reflecting material, reflects solar energy to a movably supported collector that is kept at the concentrated line focus reflector primary. The primary reflector may be constructed by a process utilizing well known freeway paving machinery. The solar energy absorber is preferably a fluid transporting pipe. Efficient utilization leading to high temperatures from the reflected solar energy is obtained by cylindrical shaped secondary reflectors that direct off-angle energy to the absorber pipe. A seriatim arrangement of cylindrical secondary reflector stages and spot-forming reflector stages produces a high temperature solar energy collection system of greater efficiency.

Official Gazette of the U.S. Patent and Trademark Office

N79-24434 Kansas Univ., Lawrence.
COMPARISON OF THREE EXPERIMENTAL METHODS USED IN DETERMINING THE THERMAL PERFORMANCE OF FLAT-PLATE SOLAR COLLECTORS Ph.D. Thesis
Gregory Barton Hotchkiss 1978 291 p
Avail: Univ. Microfilms Order No. 7910636

Three experimental methods for evaluating the thermal performance of flat-plate solar collectors are presented. The methods are classified according to the nature of the ambient conditions encountered during experimental testing. The classifications are: (1) steady state, (2) quasi-steady state, and (3) unsteady state. Experimental tests on two solar collectors were conducted in an indoor solar simulator and also out-of-doors. From the experimental collector data, collector efficiency factors, which describe the steady state behavior of a collector, were determined for each experimental method. A parameter identification method based upon a discrete gradient optimization technique was used to determine the collector parameters from unsteady state data. The design, construction, and operation of the test rig which was used to obtain the experimental data is also described.
Dissert. Abstr.

N79-24435*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS). VOLUME 1: EXECUTIVE SUMMARY
Oct. 1978 49 p refs Prepared in cooperation with DOE, Washington, D. C. 2 Vol.
(NASA-TM-80354; DOE/ER-0021/1) Avail: NTIS HC A03/MF A01 CSCL 10B

Volume 1 of a two volume report is presented. Volume 2 provides a abstract of the more technically explicit information contained in Volume 2 concerning the preliminary assessment of the impact of the Satellite Power System (SPS) on the environment for the edification of the interested layman. Topics discussed in this volume include: (1) microwave health and ecological effects; (2) other effects on health and the environment; (3) effects on the atmosphere; and (4) effects on communication.
G.Y.

N79-24436*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS). VOLUME 2: DETAILED ASSESSMENT
Oct. 1978 175 p refs Prepared in cooperation with DOE, Washington, D. C. 2 Vol.
(NASA-TM-80355; DOE/ER-0021/2) Avail: NTIS HC A08/MF A01 CSCL 10B

Volume 2 provides a preliminary assessment of the impact of the Satellite Power System (SPS) on the environment in a technically detailed format more suitable for peer review than the executive summary of Vol. 1. It serves to integrate and assimilate information that has appeared in documents referenced herein and to focus on issues that are purely environmental. It discloses the state-of-knowledge as perceived from recently completed DOE-sponsored studies and defines prospective research and study programs that can advance the state-of-knowledge and provide an expanded data base for use in an assessment planned for 1980. Alternatives for research that may be implemented in order to achieve this advancement are also discussed.
Author

N79-24437*# AiResearch Mfg. Co., Torrance, Calif.
PROTOTYPE SOLAR HEATING AND COOLING SYSTEMS Monthly Progress Report, 1 Nov. 1978 - 28 Feb. 1979
Apr. 1979 48 p Prepared for DOE
(Contract NAS8-32091)
(NASA-CR-161204) Avail: NTIS HC A03/MF A01 CSCL 10A

A combination of monthly progress reports are presented. It contains a summary of activities and progress made from November 1, 1978, to February 28, 1979. The effort calls for the development, manufacture, test, system installation, maintenance, problem resolution, and performance evaluation.
G.Y.

N79-24438*# Fern Engineering Co., Buzzards Bay, Mass.
TEST AND EVALUATION OF FERN ENGINEERING COMPANY, INCORPORATED, SOLAR HEATING AND HOT WATER SYSTEM
Apr. 1979 24 p Prepared for NASA and DOE
(Contract NAS8-32246)
(NASA-CR-161191) Avail: NTIS HC A02/MF A01 CSCL 10A

Tests, test results, examination and evaluation by Underwriters Laboratory, Inc., of a single family solar heating and hot water system consisting of collector, storage, control, transport, and data acquisition are presented. The structural characteristics of the solar flat plate collectors were evaluated according to snow and wind loads indicated in various building codes to determine their suitability for use both Michigan and Pennsylvania where prototype systems were installed. The flame spread classification of the thermal insulation is discussed and the fire tests conducted on components are described. The operation and dielectrics withstand tests of the energy transport module indicate the module is capable of rated air delivery. Tests of the control panel indicate the relay coil temperatures exceed the temperature limits allowed for the insulating materials involved.
A.R.H.

N79-24439*# National Aeronautics and Space Administration, Washington, D. C.
SOLAR TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY
May 1979 75 p Transl. into ENGLISH of "Solartechnik in der Bundesrepublik Deutschland", Rept. Bundesverband Solarenergie, Athens, 10 Nov. 1978 p 1-38 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75634) Avail: NTIS HC A04/MF A01 CSCL 10A

A series of papers dealing with the status of solar research and development in the Federal Republic of Germany are presented at a conference in Greece with the object of promoting international cooperation in solar energy utilization. The reports focus on solar collector designs, solar systems, heat pumps, solar homes, solar cooling and refrigeration, desalination and electric power generation. Numerous examples of systems produced by German manufacturers are illustrated and described, and performance data are presented.
Author

N79-24440# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
THERMODYNAMIC STUDIES OF MnS AND FeS BY CaF2 SOLID ELECTROLYTE GALVANIC CELL TECHNIQUE
Toshio Oishi, Toshio Fujimura, Kuniaki Ogura, and Joichiro Moriyama 1979 17 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Japan), v. 40, no. 9, 1976 p 969-973
(NRC/CNR-TT-1929; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

Results of the measurements for the free energy of formation of FeS and MnS using CaF2 electrolyte are given as well as first order equations expressing the relationships between electromotive force measurements in each case with the temperature. A satisfactory additive relationship among the three cases is observed.
M.M.M.

N79-24441*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROGRAMMABLE POWER PROCESSOR FOR A 25-kW POWER MODULE
Roy Lanier, Jr., Robert E. Kapustka, and John R. Bush, Jr. Jan. 1979 23 p refs
(NASA-TM-78215) Avail: NTIS HC A03/MF A01 CSCL 10B

A discussion of the power processor for an electrical power system for a 25-kW Power Module that could support the Space Shuttle program during the 1980's and 1990's and which could be a stepping stone to future large space power systems is presented. Trades that led to the selection of a microprocessor-controlled power processor are briefly discussed. Emphasis is given to the power processing equipment that uses a microprocessor to provide versatility that allows multiple use and to provide for future growth by reprogramming output voltage to a higher level (to 120 V from 30 V). Efficiency data from a breadboard

programmable power processor are presented, and component selection and design considerations are also discussed. G.Y.

N79-24442*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDOX FLOW CELL ENERGY STORAGE SYSTEMS
Lawrence H. Thaller 1979 11 p refs
(Contract E(49-28)-1002)
(NASA-TM-79143; DOE/NASA/1002-79/3; E-9996) Avail: NTIS HC A02/MF A01 CSCL 10A

NASA-Redox systems are electrochemical storage devices that use two fully soluble Redox couples, anode and cathode fluids, as active electrode materials separated by a highly selective ion exchange membrane. The reactants are contained in large storage tanks and pumped through a stack of Redox flow cells where the electrochemical reactions (reduction and oxidation) take place at porous carbon felt electrodes. A string or stack of these power producing cells is connected in series in a bipolar manner. Redox energy storage systems promise to be inexpensive and possess many features that provide for flexible design, long life, high reliability and minimal operation and maintenance costs. These features include independent sizing of power and storage capacity requirements and inclusion within the cell stack of a cell that monitors the state of charge of the system as a whole, and a rebalance cell which permits continuous correction to be made for minor side reactions that would tend to result in the anode fluid and cathode fluids becoming electrochemically out of balance. These system features are described and discussed. L.S.

N79-24443*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF PHOTOVOLTAIC VILLAGE POWER SYSTEMS IN THE UNITED STATES AND AFRICA
A. F. Ratajczak and W. J. Bifano 1979 13 p refs Presented at the Photovoltaic Solar Energy Conf., Berlin, 23-26 Apr. 1979
(Contract DE-A101-79ET20485)
(NASA-TM-79149; DOE/NASA/20485-79/1; E-005) Avail: NTIS HC A02/MF A01 CSCL 10B

Photovoltaic power systems in remote villages in the United States and Africa are described. These projects were undertaken to demonstrate that existing photovoltaic system technology is capable of providing electrical power for basic domestic services for the millions of small, remote communities in both developed and developing countries. One system is located in the Papago Indian Village of Schuchuli in southwest Arizona (U. S.) and became operational 16 December 1978. The other system is located in Tangaye, a rural village in Upper Volta, Africa. It became operational 1 March 1979. The Schuchuli system has a 3.5 kW (peak) solar array which provides electric power for village water pumping, a refrigerator for each family, lights in the village buildings, and a community washing machine and sewing machine. The 1.8 kW (peak) Tangaye system provides power for community water pumping, flour milling and lights in the milling building. These are both stand-alone systems (i.e., no back-up power source) which are being operated and maintained by local personnel. Both systems are instrumented. Systems operations are being monitored by NASA to measure design adequacy and to refine designs for future systems. J.M.S.

N79-24444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BENEFITS OF ADVANCED TECHNOLOGY IN INDUSTRIAL COGENERATION
G. J. Barna and R. K. Burns 1979 29 p Presented at EPRI Workshop on Cogeneration, San Antonio, Tex., 1-4 Apr. 1979
(Contract EC-77-A-31-1062)
(NASA-TM-79160; DOE/NASA/1062-79/1; E-016) Avail: NTIS HC A03/MF A01 CSCL 10B

This broad study is aimed at identifying the most attractive advanced energy conversion systems for industrial cogeneration for the 1985 to 2000 time period and assessing the advantages of advanced technology systems compared to using today's commercially available technology. Energy conversion systems being studied include those using steam turbines, open cycle gas turbines, combined cycles, diesel engines, Stirling engines, closed cycle gas turbines, phosphoric acid and molten carbonate fuel cells and thermionics. Specific cases using today's commercially available technology are being included to serve as a baseline for assessing the advantages of advanced technology. L.S.

N79-24445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDOX FLOW CELL DEVELOPMENT AND DEMONSTRATION PROJECT, CALENDAR YEAR 1977
Jan. 1979 53 p refs
(Contract E(49-28)-1002)
(NASA-TM-79067; DOE/NASA/1002-78/2; E-9883) Avail: NTIS HC A04/MF A01 CSCL 10A

Research and development on the redox flow cell conducted from January 1, 1977, to December 31, 1977, are described in this report. The major focus of the effort during 1977 was the key technology issues that directly influence the fundamental feasibility of the overall redox concept. These issues were the development of a suitable ion exchange membrane for the system, the screening and study of candidate redox couples to achieve optimum cell performance, and the carrying out of systems analysis and modeling to develop system performance goals and cost estimates. L.S.

N79-24446*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OPTIMIZATION OF AN MHD GENERATOR WITH PHYSICAL CONSTRAINTS
C. C. P. Pian, G. R. Seikel, and J. Marlin Smith 1979 12 p refs Proposed for presentation at 14th Intersoc. Energy Conversion Eng. Conf., Boston, 5-10 Aug. 1979
(Contract EF-77-A-01-2674)
(NASA-TM-79172; DOE/NASA/2674-79/5; E-036) Avail: NTIS HC A02/MF A01 CSCL 10B

A method to optimize the Faraday MHD generator performance under a prescribed set of electrical and magnet constraints is described. The results of generator performance calculations using this technique are presented for a very large MHD/steam plant. The differences between the maximum power and maximum net power generators are described. The sensitivity of the generator performance to the various operational parameters are presented. Author

N79-24447*# Sah (C. T.) Associates, Urbana, Ill.
STUDY OF THE EFFECTS OF IMPURITIES ON THE PROPERTIES OF SILICON MATERIALS AND PERFORMANCE OF SILICON SOLAR CELL
C. T. Sah Mar. 1979 95 p refs Prepared for JPL and DOE
(Contract JPL-954685)
(NASA-CR-158678; DOE/JPL-954685-79/1; TR-2) Avail: NTIS HC A05/MF A01 CSCL 10A

Numerical solutions were obtained from the exact one dimensional transmission line circuit model to study the following effects on the terrestrial performance of silicon solar cells: interband Auger recombination; surface recombination at the contact interfaces; enhanced metallic impurity solubility; diffusion profiles; and defect-impurity recombination centers. Thermal recombination parameters of titanium impurity in silicon were estimated from recent experimental data. Based on those parameters, computer model calculations showed that titanium concentration must be kept below 6x10 to the 12th power Ti/cu cm in order to achieve 16% AM1 efficiency in a silicon solar cell of 250 micrometers thick and 1.5 ohm-cm resistivity. R.E.S.

N79-24448*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF A MODEL AND COMPUTER CODE TO DESCRIBE SOLAR GRADE SILICON PRODUCTION PROCESSES
R. Srivastava and R. K. Gould May 1979 33 p refs Prepared for DOE
(Contract JPL-954862)
(NASA-CR-158679; AeroChem-TN-206; DOE/JPL-954862-79/6; QR-6) Avail: NTIS HC A03/MF A01 CSCL 10A

Mathematical models and computer codes based on these models, which allow prediction of the product distribution in chemical reactors for converting gaseous silicon compounds to condensed-phase silicon were developed. The following tasks were

accomplished: (1) formulation of a model for silicon vapor separation/collection from the developing turbulent flow stream within reactors of the Westinghouse (2) modification of an available general parabolic code to achieve solutions to the governing partial differential equations (boundary layer type) which describe migration of the vapor to the reactor walls, (3) a parametric study using the boundary layer code to optimize the

accomplished: (1) formulation of a model for silicon vapor separation/collection from the developing turbulent flow stream within reactors of the Westinghouse (2) modification of an available general parabolic code to achieve solutions to the governing partial differential equations (boundary layer type) which describe migration of the vapor to the reactor walls, (3) a parametric study using the boundary layer code to optimize the performance characteristics of the Westinghouse reactor, (4) calculations relating to the collection efficiency of the new AeroChem reactor, and (5) final testing of the modified LAPP code for use as a method of predicting Si(1) droplet sizes in these reactors. S.E.S.

N79-24449*# Texas Instruments, Inc., Dallas.
LSA SILICON MATERIAL TASK CLOSED-CYCLE PROCESS DEVELOPMENT Interim Summary Report, Aug. - Dec. 1978
R. A. Roques, G. F. Wakefield, J. M. Blocher, Jr. (Battelle Columbus Labs., Ohio), M. F. Browning (Battelle Columbus Labs., Ohio), and W. Wilson (Battelle Columbus Labs., Ohio) Mar. 1979 15 p refs Prepared for JPL and DOE
(Contract JPL-955006)
(NASA-CR-158677; TI-03-79-17; DOE/JPL-955006-79/2) Avail: NTIS HC A02/MF A01 CSCL 10A

The initial effort on feasibility of the closed cycle process was begun with the design of the two major items of untested equipment, the silicon tetrachloride by product converter and the rotary drum reactor for deposition of silicon from trichlorosilane. The design criteria of the initial laboratory equipment included consideration of the reaction chemistry, thermodynamics, and other technical factors. Design and construction of the laboratory equipment was completed. Preliminary silicon tetrachloride conversion experiments confirmed the expected high yield of trichlorosilane, up to 98 percent of theoretical conversion. A preliminary solar-grade polysilicon cost estimate, including capital costs considered extremely conservative, of $6.91/kg supports the potential of this approach to achieve the cost goal. The closed cycle process appears to have a very likely potential to achieve LSA goals. Author

N79-24450*# Spire Corp., Bedford, Mass.
DEVELOPMENT OF PULSED PROCESSES FOR THE MANUFACTURE OF SOLAR CELLS Quarterly Progress Report, 15 Sep. - 15 Dec. 1978
Jan. 1979 49 p refs Prepared for JPL and DOE
(Contract JPL-954786)
(NASA-CR-158676; QR-77-10052-4; DOE/JPL-954786-79/1; QPR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The development status of the process based upon ion implantation for the introduction of junctions and back surface fields is described. A process sequence is presented employing ion implantation and pulse processing. Efforts to improve throughout and descrease process element costs for furnace annealing are described. Design studies for a modular 3,000 wafer per hour pulse processor are discussed. R.E.S.

N79-24451*# Texas Instruments, Inc., Dallas.
LSA LARGE AREA SILICON SHEET TASK CONTINUOUS CZOCHRALSKI PROCESS DEVELOPMENT Final Report
Samuel N. Rea Feb. 1979 59 p refs Prepared for JPL and DOE
(Contract JPL-954887)
(NASA-CR-158675; TI-03-79-10; DOE/JPL-954887-79/5) Avail: NTIS HC A04/MF A01 CSCL 10A

A commercial Czochralski crystal growing furnace was converted to a continuous growth facility by installation of a small, in-situ premelter with attendant silicon storage and transport mechanisms. Using a vertical, cylindrical graphite heater containing a small fused quartz test tube linear from which the molten silicon flowed out the bottom, approximately 83 cm of nominal 5 cm diamter crystal was grown with continuous melt addition furnished by the test tube premelter. High perfection crystal was not obtained, however, due primarily to particulate contamination of the melt. A major contributor to the particulate problem was severe silicon oxide buildup on the premelter which would ultimately drop into the primary melt. Elimination of this oxide buildup will require extensive study and experimentation and the ultimate success of continuous Czochralski depends on a successful solution to this problem. Economically, the continuous Czochralski meets near-term cost goals for silicon sheet material. R.E.S.

N79-24452*# Spire Corp., Bedford, Mass.
INTEGRAL GLASS ENCAPSULATION FOR SOLAR ARRAYS Interim Report
successful solution to this problem. Economically, the continuous Czochralski meets near-term cost goals for silicon sheet material. R.E.S.

N79-24452*# Spire Corp., Bedford, Mass.
INTEGRAL GLASS ENCAPSULATION FOR SOLAR ARRAYS Interim Report
P. R. Younger, R. G. Tobin, and W. S. Kreisman Mar. 1979 76 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954521)
(DOE/JPL-954521-79/9; NASA-CR-158668; IR-2) Avail: NTIS HC A05/MF A01 CSCL 10A

Work reported was performed during the period from August 1977 to December 1978. The program objective was to continue the development of electrostatic bonding (ESB) as an encapsulation technique for terrestrial cells. Economic analyses shows that this process can be a cost-effective method of producing reliable, long lifetime solar modules. When considered in sufficient volume, both material and equipment costs are competitive with conventional encapsulation systems. In addition, the possibility of integrating cell fabrication into the encapsulation process, as in the case of the preformed cell contacts discussed in this report, offers the potential of significant overall systems cost reduction. G.Y.

N79-24453*# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
SILICON-ON-CERAMIC PROCESS: SILICON SHEET GROWTH AND DEVICE DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET AND CELL DEVELOPMENT TASKS OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Report, 1 Jan. - 30 Mar. 1979
P. W. Chapman, J. D. Zook, J. D. Heaps, B. L. Grung, B. Koepke, and S. B. Schuldt 30 Apr. 1979 46 p refs Prepared for JPL and DOE
(Contract JPL-954356)
(NASA-CR-158669; DOE/JPL-954356-79/8; QR-11) Avail: NTIS HC A03/MF A01 CSCL 10A

Significant progress is reported in fabricating a 4 sq cm cell having a 10.1 percent conversion efficiency and a 10 sq cm cell having a 9.2 percent conversion efficiency. The continuous (SCIM) coater succeeded in producing a 16 sq cm coating exhibiting unidirectional solidification and large grain size. A layer was grown at 0.2 cm/sec in the experimental coater which was partially dendritic but also contained a large smooth area approximately 100 micron m thick. The dark characteristic measurements of a typical SCC solar cell yield shunt resistance values of 10K ohms and series resistance values and 0.4 ohm. The production dip-coater is operating at over 50 percent yield in terms of good cell quality material. The most recent run yielded 13 good substrates out of 15. A.R.H.

N79-24454*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
DEVELOPMENT OF HIGH EFFICIENCY (14%) SOLAR CELL ARRAY MODULE Quarterly Report, 29 Nov. 1978 - 15 Mar. 1979
P. A. Iles, S. Khemthong, S. Olah, W. J. Sampson, and K. S. Ling 15 Mar. 1979 30 p refs Prepared for JPL and DOE
(Contract JPL-955217)
(NASA-CR-158672; QR-1; DOE/JPL-955217-79/4) Avail: NTIS HC A03/MF A01 CSCL 10A

High efficiency solar cells required for the low cost modules was developed. The production tooling for the manufacture of the cells and modules was designed. The tooling consisted of: (1) back contact soldering machine; (2) vacuum pickup; (3) antireflective coating tooling; and (4) test fixture. S.E.S.

N79-24455*# ARCO Solar, Inc., Chatsworth, Calif.
AUTOMATED SOLAR PANEL ASSEMBLY LINE. LSA TASK; PRODUCTION PROCESSES AND EQUIPMENT
H. Somberg 8 Apr. 1979 18 p Prepared for JPL and DOE
(Contract JPL-955278)
(NASA-CR-158671; DOE/JPL-955278-79/1; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

An automated solar panel production line which reduces the module assembly costs was designed. The module design,

solar cell assembly phototype, and solar panel lamination prototype are discussed. S.E.S.

N79-24456*# Solarex Corp., Rockville, Md.
ANALYSIS OF THE EFFECTS OF IMPURITIES IN SILICON Quarterly Report, 19 Jan. - 30 Apr. 1979
J. H. Wohlgemuth 30 Apr. 1979 36 p refs Prepared for JPL
(Contract JPL-955307)
(NASA-CR-157439; DOE/JPL-955307-79/1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

A solar cell fabrication and analysis program was conducted to determine the effects on the resultant solar cell efficiency of impurities intentionally incorporated into silicon. The program employed flight quality technologies and quality assurance to assure that variations in cell performance were due to the impurities incorporated in the silicon. The initial verification runs have resulted in an average AMO cell efficiency of 12.8% at 25 C. R.E.S.

N79-24457*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY (LSA) PROJECT Quarterly Report, Jan. - Mar. 1978
Mar. 1978 72 p Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158650; JPL-Pub-79-14; DOE/JPL-1012-2; QR-8) Avail: NTIS HC A04/MF A01 CSCL 10A

Progress made by the Low-Cost Silicon Solar Array Project during the period January through March 1978 is reported. It includes task reports on silicon material processing, large-area silicon sheet development, encapsulation materials testing and development, project engineering and operations, and manufacturing techniques, plus the steps taken to integrate these efforts. G.Y.

N79-24458*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY (LSA) PROJECT Quarterly Report, Apr. - Jun. 1978
Jun. 1978 60 p Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158651; JPL-Pub-79-15; DOE/JPL-1012-3; QR-9) Avail: NTIS HC A04/MF A01 CSCL 10A

The activities of the Low-Cost Solar Array Project are described for the period April through June 1978. The Project is assigned responsibility for advancing solar array technology while encouraging industry to reduce the price of arrays to a level at which photovoltaic electric power systems will be competitive with more conventional power sources early in the next decade. Set forth are the goals and plans with which the Project intends to accomplish this and the progress that was made during the quarter. G.Y.

N79-24459*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LSA: LOW-COST SOLAR ARRAY PROJECT Quarterly Report, Jul. 1978 - Sep. 1978
Sep. 1978 61 p
(Contract NAS7-100; JPL Proj. 5101-100)
(NASA-CR-158533; JPL-Pub-79-43-Vol-1; /JPL-1012-4) Avail: NTIS HC A04/MF A01 CSCL 10A

Topics discussed include silicon material processing; large-area silicon sheet development; encapsulation materials testing and development; project engineering and operations activities, and manufacturing techniques. The steps taken to integrate these efforts, are described. A.R.H.

N79-24460*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL STORAGE APPLICATIONS WORKSHOP. VOLUME 1: PLENARY SESSION ANALYSIS
15 Feb. 1979 21 p Workshop held at Golden, Colo., 14-15 Feb. 1978 Prepared for NASA and DOE 2 Vol.
(Contract NAS7-100; JPL Proj. 5102-78)
(NASA-CR-158643; JPL-Pub-79-8-Vol-1; DOE/JPL-1060-12-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 10C

The importance of the development of inexpensive and efficient thermal and thermochemical energy storage technology to the solar power program is discussed in a summary of workshop discussions held to exchange information and plan for future systems. Topics covered include storage in central power applications such as the 10 MW-e demonstration pilot receiver to be constructed in Barstow, California; storage for small dispersed systems, and problems associated with the development of storage systems for solar power plants interfacing with utility systems. A.R.H.

N79-24461*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL STORAGE APPLICATIONS WORKSHOP. VOLUME 2: CONTRIBUTED PAPERS
15 Feb. 1979 282 p refs Workshop held at Golden, Colo., 14-15 Feb. 1978 Prepared for NASA and DOE 2 Vol.
(Contract NAS7-100; JPL Proj. 5102-78)
(NASA-CR-158644; JPL-Pub-79-8-Vol-2; DOE/JPL-1060-12-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 10C

The solar thermal and the thermal and thermochemical energy storage programs are described as well as the technology requirements for both external (electrical) and internal (thermal, chemical) modes for energy storage in solar power plants. Specific technical issues addressed include thermal storage criteria for solar power plants interfacing with utility systems; optimal dispatch of storage for solar plants in a conventional electric grid; thermal storage/temperature tradeoffs for solar total energy systems; the value of energy storage for direct-replacement solar thermal power plants; systems analysis of storage in specific solar thermal power applications; the value of seasonal storage of solar energy; criteria for selection of the thermal storage system for a 10 MW(2) solar power plant; and the need for specific requirements by storage system development teams. A.R.H.

N79-24462*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS, SMALL POWER SYSTEMS APPLICATION PROJECT. VOLUME 1: EXECUTIVE SUMMARY Annual Technical Report, FY 1978
A. T. Marriott 15 Jan. 1979 76 p Prepared for DOE
(Contract NAS7-100; JPL Proj. 5103-36)
(NASA-CR-157441; JPL-Pub-79-43-Vol-1; DOE/JPL-1060-9) Avail: NTIS HC A05/MF A01 CSCL 10B

Current small power system technology as applied to power plants up to 10 MWe in size was assessed. Markets for small power systems were characterized and cost goals were established. Candidate power plant system design concepts were selected for evaluation and preliminary performance and cost assessments were made. Economic studies were conducted and breakeven capital costs were determined for leading contenders among the candidate systems. An application study was made of the potential use of small power systems in providing part of the demand for pumping power by the extensive aqueduct system of California, estimated to be 1000 MWe by 1985. Criteria and methodologies were developed for application to the ranking of candidate power plant system design concepts. Experimental power plants concepts of 1 MWe rating were studied leading toward the definition of a power plant configuration for subsequent detail design, construction, testing and evaluation as Engineering Experiment No. 1 (EE No. 1). Site selection criteria and ground rules for the solicitation of EE No. 1 site participation proposals by DOE were developed. A.R.H.

N79-24463*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-EFFICIENCY THIN-FILM GaAs SOLAR CELLS Final Report
R. J. Stirn 15 Apr. 1979 99 p refs Prepared for NASA and DOE
(Contract NAS7-100)
(NASA-CR-158641; JPL-Pub-79-38) Avail: NTIS HC A05/MF A01 CSCL 10A

GaAs chemical vapor deposition (CVD) growth on single-crystal GaAs substrates was investigated over a temperature range of 600 to 750 C, As/GA mole-ratio range of 3 to 11, and gas molefraction range 5 x 10 to the minus 9th power to 7x 10 to the minus 7th power for H2S doping. GasAs CVD growth on recrystallized Ge films was investigated for a temperature range of 550 to 700 C, an As/GA mole ratio of 5, and for various H2S mole fraction. The highest efficiency cell observed on these films with 2 mm dots was 4.8% (8% when AR-coated). Improvements in fill factor and opencircuit voltage

by about 40% each are required in order to obtain efficiencies of 15% or greater. M.M.M.

N79-24464*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS, POINT-FOCUSING DISTRIBUTED RECEIVER TECHNOLOGY PROJECT. VOLUME 2: DETAILED REPORT Annual Technical Report, Fiscal Year 1978
John Lucas 15 Mar. 1979 124 p refs Prepared for DOE
(Contract NAS7-100; JPL Proj. 5104-26)
(NASA-CR-158534; DOE/JPL-1060-7; JPL-Pub-79-1) Avail: NTIS HC A06/MF A01 CSCL 10A

Thermal or electrical power from the sun's radiated energy through Point-Focusing Distributed Receiver technology is the goal of this Project. The energy thus produced must be economically competitive with other sources. The Project supports the industrial development of technology and hardware for extracting energy from solar power to achieve the stated goal. Present studies are working to concentrate the solar energy through mirrors or lenses, to a working fluid or gas, and through a power converter change to an energy source useful to man. Rankine-cycle and Brayton-cycle engines are currently being developed as the most promising energy converters for our near future needs. Author

N79-24465*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE PARABOLIC CONCENTRATING COLLECTOR: A TUTORIAL
V. C. Truscello 15 Feb. 1979 47 p refs Prepared for JPL and DOE
(Contracts NAS7-100; EX-76-A-29-1060; JPL Proj. 5102-107)
(NASA-CR-158639; JPL-Pub-79-7; DOE/JPL-1060-79/1) Avail: NTIS HC A03/MF A01 CSCL 10A

A tutorial overview is presented of point-focusing parabolic collectors. Optical and thermal characteristics of such collectors are discussed. Data representing typical achievable collector efficiencies are presented and the importance of balancing collector cost with concentrator quality is argued. The impact of receiver temperature on performance is assessed and the general observation made that temperatures much in excess of 1500-2000 F can actually result in decreased performance. Various types of two-axis tracking collectors are described. The present DOE program to develop these devices is briefly discussed, as are present and projected costs for these collectors. G.Y.

N79-24466*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HEAP: HEAT ENERGY ANALYSIS PROGRAM, A COMPUTER MODEL SIMULATING SOLAR RECEIVERS
F. L. Lansing 15 Jan. 1979 138 p refs Prepared For NASA and JPL
(Contract NAS7-100; JPL Proj. 5102-106)
(NASA-CR-158640; DOE/JPL-1060-13; JPL-PUB-79-13) Avail: NTIS HC A07/MF A01 CSCL 10A

A computer program which can distinguish between different receiver designs, and predict transient performance under variable solar flux, or ambient temperatures, etc. has a basic structure that fits a general heat transfer problem, but with specific features that are custom-made for solar receivers. The code is written in MBASIC computer language. The methodology followed in solving the heat transfer problem is explained. A program flow chart, an explanation of input and output tables, and an example of the simulation of a cavity-type solar receiver are included.A.R.H.

N79-24467# Committee on Banking, Housing and Urban Affairs (U. S. Senate).
IMPACT OF SOLAR ENERGY ON RURAL HOUSING
Washington GPO 1978 303 p refs Hearings before the Subcomm. on Rural Housing of the Comm. on Banking, Housing, and Urban Affairs, 95th Congr., 2d Sess., 19-20 Jul. 1978
(GPO-31-641) Avail: Subcomm. on Rural Housing

The subject of solar energy and the impact that this technology can have on te life of rural families is discussed through witness testimony from Government and private industry. G.Y.

N79-24468# National Inst. for Water Research, Pretoria (South Africa).
ENERGY RECOVERY FROM DOMESTIC REFUSE BY MEANS OF INCINERATION AND PYROLYSIS
J. H. Nell 1978 34 p refs
(CSIR-SR-WAT-54; ISBN-0-7988-1399-7) Avail: NTIS HC A03/MF A01

The present status of energy recovery from domestic refuse by means of incineration and pyrolysis is reviewed. Technological and cost aspects are discussed, while examples of plants presently in operation are given. It is concluded that energy recovery from domestic refuse has certain advantages over conventional disposal methods with respect to land requirements, pollution control, recycling of valuable materials, recovery of energy and costs. However, the disadvantages, especially the high capital expenditure required to comply with strict air pollution regulations, necessitate an observation period of five to eight years in order to assess the applicability of the process for local conditions. Author

N79-24469*# Westinghouse Research and Development Center, Pittsburgh, Pa.
THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SOLAR ARRAY PROJECT, PHASE 2 Annual Report, 1 Oct. 1977 - 30 Oct. 1978
R. B. Campbell, ed. and S. Farukhi, ed. 16 Nov. 1978 185 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954873)
(NASA-CR-158538; DOE/JPL-954873-78/01; JPL-9950-28; AR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

During the program a process sequence was proposed and tested for the fabrication of dendritic welb silicon into solar modules. This sequence was analyzed as to yield and cost and these data suggest that the price goals of 1986 are attainable. Specifically, it was shown that a low cost POCL3 is a suitable replacement for the semiconductor grade, and that a suitable CVD oxide can be deposited from a silane/air mixture using a Silox reactor. A dip coating method was developed for depositing an antireflection coating from a metalorganic precursor. Application of photoresist to define contact grids was made cost effective through use of a dip coating technique. Electroplating of both Ag and Cu was shown feasible and cost effective for producing the conductive metal grids on the solar cells. Laser scribing was used to separate the cells from the dendrites without degradation. Ultrasonic welding methods were shown to be feasible for interconnecting the cells. A study of suitable low cost materials for encapsulation suggest that soda lime glass and phenolic filled board are preferred. L.S.

N79-24470*# Eagle-Picher Industries, Inc., Miami, Okla.
STUDY PROGRAM TO DEVELOP AND EVALUATE DIE AND CONTAINER MATERIALS FOR THE GROWTH OF SILICON RIBBONS Quarterly Report
P. D. Ounby, B. B. Yu, and M. W. Barsoum Jan. 1979 46 p Sponsored by DOE
(Contract JPL-954877)
(NASA-CR-158543; DOE/JPL-954877-78/5; JPL-9950-38; QR-5) Avail: NTIS HC A03/MF A01 CSCL 10A

The completion of a major hardware delivery milestone was accomplished with the delivery of three CNTD Si3N4 coated hot pressed Si3N4 crucibles. A limited characterization of the coating was performed at MRL prior to delivery. The coatings were fine grained alpha - Si3N4. It was determined that a two piece die design is required. The importance of the role of oxygen in influencing the attack of the CNTD materials by molten silicon was demonstrated. The stability is greatly enhanced by maintaining the oxygen partial pressure near or below the Si + O2 = SiO2 equilibrium. G.Y.

N79-24471*# Dow Corning Corp., Midland, Mich.
DEVELOP SILICONE ENCAPSULATION SYSTEMS FOR TERRESTRIAL SILICON SOLAR ARRAYS Interim Report, 15 Feb. - 31 Dec. 1978
Mar. 1979 78 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954995)
(NASA-CR-158537; DOE/JPL-954995-78/3; JPL-9950-39) Avail: NTIS HC A05/MF A01 CSCL 10A

The results for Task 3 of the Low Cost Solar Array Project are presented. Task 3 is directed toward the development of a cost effective encapsulating system for photovoltaic modules using silicon based materials. The technical approach of the contract

effort is divided into four special tasks: (1) technology review; (2) generation of concepts for screening and processing silicon encapsulation systems; (3) assessment of encapsulation concepts; and (4) evaluation of encapsulation concepts. The candidate silicon materials are reviewed. The silicon and modified silicon resins were chosen on the basis of similarity to materials with known weatherability, cost, initial tangential modulus, accelerated dirt pick-up test results and the ratio of the content of organic phenyl substitution of methyl substitution on the backbone of the silicon resin. G.Y.

N79-24472*# Westinghouse Research and Development Center, Pittsburgh, Pa.
EFFECTS OF IMPURITIES AND PROCESSING ON SILICON SOLAR CELLS, PHASE 3 Quarterly Report, Jan. - Mar. 1979
R. H. Hopkins, J. R. Davis, P. D. Blais, A. Rohatgi, R. B. Campbell, P. Rai-Choudhury, R. E. Stapleton, H. C. Mollenkopf (Dow Corning Corp.), and J. R. McCormick (Dow Corning Corp.) Apr. 1979 76 p refs Prepared for JPL and DOE
(Contract JPL-954331)
(NASA-CR-158569; DOE/JPL-954331-79/2; QR-14) Avail: NTIS HC A05/MF A01 CSCL 10A

Results of the 14th quarterly report are presented for a program designed to assess the effects of impurities, thermochemical processes and any impurity process interactions on the performance of terrestrial silicon solar cells. The Phase 3 effort encompasses: (1) potential interactions between impurities and thermochemical processing of silicon; (2) impurity-cell performance relationships in n-base silicon; (3) effect of contaminants introduced during silicon production, refining or crystal growth on cell performance; (4) effects of nonuniform impurity distributions in large area silicon wafers; and (5) a preliminary study of the permanence of impurity effects in silicon solar cells. G.Y.

N79-24473*# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
LASER-ZONE GROWTH IN A RIBBON-TO-RIBBON (RTR) PROCESS SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SOLAR ARRAY PROJECT Technical Quarterly Report, 1 Jan. - 31 Mar. 1979
A. Baghdadi, R. W. Gurtler, R. Legge, B. Sopori, M. J. Rice, and R. J. Ellis 1979 34 p refs Prepared for JPL and DOE
(Contract JPL-954376; JPL Proj. 2319-25)
(NASA-CR-158570; Rept-2256/13; TQR-10) Avail: NTIS HC A03/MF A01 CSCL 10A

A technique for growing limited-length ribbons continually was demonstrated. This Rigid Edge technique can be used to recrystallize about 95% of the polyribbon feedstock. A major advantage of this method is that only a single, constant length silicon ribbon is handled throughout the entire process sequence; this may be accomplished using cassettes similar to those presently in use for processing Czochralski waters. Thus a transition from Cz to ribbon technology can be smoothly affected. The maximum size being considered, 3 inches x 24 inches, is half a square foot, and will generate 6 watts for 12% efficiency at 1 sun. Silicon dioxide has been demonstrated as an effective, practical diffusion barrier for use during the polyribbon formation. G.Y.

N79-24474# Naval Civil Engineering Lab., Port Hueneme, Calif.
CORROSION AND BIOFOULING OF OTEC SYSTEM SURFACES; DESIGN FACTORS Final Report, Jun. 1976 - Mar. 1978
James F. Jenkins Nov. 1978 58 p refs Sponsored in part by DOE
(AD-A066115; CEL-TR-868) Avail: NTIS HC A04/MF A01 CSCL 10/2

Biofouling and corrosion of Ocean Thermal Energy Conversion (OTEC) plants are critical factors in the economic feasibility of the OTEC concept. As the mission and operating requirements of an OTEC plant are significantly different than those for any existing facility, many unique materials and design problems must be addressed. This report identifies factors that influence biofouling and corrosion, recommends specific design features where appropriate, and identifies items requiring further investigation. Author (GRA)

N79-24475# Naval Civil Engineering Lab., Port Hueneme, Calif.
DIGEST OF EQUIPMENT FOR CONVERTING SOLAR, WIND, AND GEOTHERMAL ENERGY INTO ELECTRIC POWER FOR USN APPLICATION ASHORE Final Report, May 1977 - Mar. 1978
William R. Lorman Nov. 1978 106 p refs
(AD-A066221; CEL-TN-1534) Avail: NTIS HC A06/MF A01 CSCL 10/2

This document enumerates principal requirements of self-sufficient electric power conversional equipment under active consideration by CEL. Data pertain to financial requirements, physical characteristics, and potential outputs of solar, wind, and geothermal energy conversion systems; these systems are part of USN shore energy research and development program. Data are intended for use by CEL systems analysts as input to mathematical model for planning and optimizing power systems throughout the Naval Shore Establishment. Author (GRA)

N79-24476# California Univ., Berkeley. Lawrence Berkeley Lab.
TRANSPARENT HEAT MIRRORS FOR PASSIVE SOLAR HEATING APPLICATIONS
Stephen Selkowitz Mar. 1978 26 p Presented at the 2d Natl. Passive Solar Conf., Philadelphia, 16-18 Mar. 1978
(Contract W-7405-eng-48)
(LBL-7829; Conf-780337-8; FFB-W-78-03) Avail: NTIS HC A03/MF A01

Progress in the development of transparent heat mirror coatings for energy efficient windows and passive solar applications is reviewed. The availability of cost efficient coatings promising savings of 25 to 75 %, depending upon application, to window manufacturers and homeowners is reported. Performance, applications, and limitations are discussed. DOE

N79-24477# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OTEC PLATFORM CONFIGURATION AND INTEGRATION STUDY. VOLUME 2: TECHNICAL CONCEPT Final Report
Apr. 1978 205 p ref
(Contract EC-77-C-01-4063)
(DOE/ET-4063-1-Vol-2) Avail: NTIS HC A10/MF A01

The cost effectiveness of the two OTEC platform configurations, the ship and the spar with detachable modules, as they apply to commercial plants with 400 MW/sub e/ net output was studied. Early examination of potential concept arrangements for the 400 MW/sub e/ plant using 25 or 50 MW/sub e/ power modules revealed that traditional materials and arrangements would not be capable of attaining cost effective designs. The ship-type conceptual design utilizes immersed heat exchangers (50 MW/sub e/) with a combined strong-back and water duct structural design in concrete to provide a platform which is estimated to cost 690 $/kW for each of the 2d to 8th units for a New Orleans site. The spar-type conceptual design, which inherently utilizes immersed heat exchangers in the detachable modules, incorporated immersed ammonia storage tanks to assist in providing net buoyancy for the core of the spar as constructed in concrete. A cost of 801 $/kW is estimated for the spar-type platform at a New Orleans site. DOE

N79-24478# Los Alamos Scientific Lab., N. Mex.
TREATMENT OF MOLYBDENITE ORE USING A 2 kW SOLAR FURNACE
S. R. Skaggs 1979 26 p Presented at the Solar Thermal Test Facilities Users Assoc., Atlanta, 27-29 Sep. 1978 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-79-6; Conf-780956-3) Avail: NTIS HC A03/MF A01

The Odello facility including the 1 MW furnace operated by the Laboratoire of Energetique Solaire, and the 1|6 and 2 kW furnaces operated by the Laboratoire des Ultra-Refractaires is described. The experiments conducted during August and September 1978 for the solar processing of molybdenite ore are described. Kinetics data on the molybdenite oxidation reaction, a mass balance in order to project to pilot plant size, and calorimetric data on the reaction was obtained. The results of these three measurements are presented graphically. The techniques being considered for pilot plant trials are discussed, and a schedule of the work to be completed is included. DOE

N79-24479# California Univ., Livermore. Lawrence Livermore Lab.

IN SITU COAL GASIFICATION MODELING

C. B. Thorsness and R. J. Cena 2 Feb. 1979 37 p refs Presented at the AICE Meeting, Houston, Tex., 1-4 Apr. 1979 (Contract W-7405-eng-48)

(UCRL-82269; Conf-790405-3) Avail: NTIS HC A03/MF A01

A two dimensional coal recovery model which incorporates several candidate mechanisms believed to control in situ gasification is presented. The model is tested against field gasification results from Hoe Creek and Hanna, Wyoming. Both experiments demonstrated wide sweep efficiency. Analysis of results based on overall material balances indicate possible large differences in the net amount of unreacted char left underground. Mathematical model to predict wide sweep efficiency for both sites require the use of a highly dispersive mechanism within the active gasification region. Tracer studies at Hoe Creek confirm the highly dispersive nature of the system. A quasi-equilibrium model is presented for calculating gas composition as a function of underground heat loss and water influx. Plans for incorporating this model in the two dimensional coal recovery model are presented. DOE

N79-24480# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT COST REPORT: RADIAN CORPORATION OFFICE BUILDING, AUSTIN, TEXAS

2 May 1978 39 p ref

(Contracts W-31-109-eng-38; EG-77-C-01-4049)

(SOLAR/2002-78/60) Avail: NTIS HC A03/MF A01

Cost information is presented for a solar heating and cooling project which utilizes 36 concentrating collectors which provide an effective aperature area of 350 square feet. The collectors are ganged in two banks on the flat roof of the building. An aluminum angle support structure tilts the collectors toward the south and the collectors track the sun from east to west through the day. A tracking mechanism is provided for each of the two banks of collectors. The 1500 gallon insulated, fiberglass storage tank is located above ground on a concrete pad near the building. The construction costs of this solar heating and cooling project are presented. Category costs are listed by materials owner direct labor and subcontract costs. The subcontract costs include both materials, labor, overhead and profit costs for mechanical and electrical subcontractors. DOE

N79-24481# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT DESCRIPTION: SCATTERGOOD SCHOOL RECREATION CENTER, WEST BRANCH, IOWA

26 May 1978 44 p

(Contracts EG-77-C-01-4049; EG-77-C-01-2522)

(SOLAR/2003-78/50) Avail: NTIS HC A03/MF A01

A 4-tier collector array, tilted at 50 deg consists of 128 double glazed collectors that use air as the heat transfer fluid. The array is attached to the southward facing gymnasium wall on a partial A-frame structure. The area between the collector array and the gymnasium wall, which is enclosed and unconditioned, houses the storage tank, air handling equipment, ductwork, and other solar system components. The storage tank is a partially buried 65 ton pebble bed tank. It is insulated with 2 inches of fiberglass. The pebbles are washed river gravel, 1 to 3 inches in diameter. Domestic hot water is preheated by a cross-flow heat exchanger located in the warm air supply duct and is stored in two 120 gallon, glass-lined, storage tanks. The solar energy system, operational since May 1977, is fully instrumented for performance evaluation and integrated into the National Solar Data Network. DOE

N79-24482# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT COST REPORT: SCATTERGOOD SCHOOL RECREATION CENTER, WEST BRANCH, IOWA

26 May 1978 35 p

(Contracts W-31-109-eng-38; EG-77-C-01-4049)

(SOLAR/2003-78/60) Avail: NTIS HC A03/MF A01

The solar energy system heats approximately 8,000 sq. ft. of recreational (gymnasium) floor space in this one story, metal building. The system utilizes a collector array of 128 modules of air heating, flat plate collectors providing 3496 sq. ft. of area. The planar collector array is supported by a steel frame structure, with the collectors being mounted on 3/4 inches plywood. Energy storage is provided by 1,250 cu. ft. of nominally one to three inch diameter rocks. Service water storage is provided by two 120 gallon glass-lined storage tanks. The construction costs of this solar heating project are presented. Category costs are listed by materials, direct labor and subcontract costs. The subcontract costs include materials, labor, overhead and profit for mechanical and electrical subcontractors only. DOE

N79-24483# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT COST REPORT: TERRELL E. MOSELEY OFFICE BUILDING, LYNCHBURG, VIRGINIA

17 May 1978 35 p

(Contracts W-31-109-eng-38; EG-77-C-01-4049)

(SOLAR/2011-78/60) Avail: NTIS HC A03/MF A01

The construction costs of a solar heating project in an office warehouse building are presented. Category costs are listed by materials, direct labor, and subcontract costs. The subcontract costs include both materials, labor, overhead and profit for mechanical and electrical subcontractors. DOE

N79-24484# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT COST REPORT: KALWALL CORPORATION WAREHOUSE, MANCHESTER, NEW HAMPSHIRE

31 May 1978 29 p

(Contracts W-31-109-eng-38; EG-77-C-01-4049)

(SOLAR/2015-78/60) Avail: NTIS HC A03/MF A01

The construction costs of this solar heating project are presented. Category costs are listed by materials, labor, and subcontract costs. The subcontract costs include both materials, labor overhead and profit for mechanical and electrical subcontractors. DOE

N79-24485# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT DESCRIPTION: ARATEX SERVICES, INCORPORATED, INDUSTRIAL LAUNDRY, FRESNO, CALIFORNIA

7 Jun. 1978 47 p

(Contracts EG-77-C-01-4049; EG-77-C-01-2522)

(SOLAR/2008-78/50) Avail: NTIS HC A03/MF A01

The process water in a large commercial laundering plant in Fresno, California was heated by solar energy. The system utilized 140 Ying, flat plate, lexan glazed collectors which provided an effective aperture area of 6500 square feet. The collectors were mounted in 24 rows on the flat roof of the building. The hot water was stored in a 4000 gallon holding tank to which an immersed heat exchanger added heat from the steam condensate. The solar system was fully instrumented for data acquisition. DOE

N79-24486# International Business Machines Corp., Huntsville, Ala.

SOLAR PROJECT DESCRIPTION: IRIS IMAGES, INCORPORTED, FILM LABORATORY, MILL VALLEY, CALIFORNIA

9 Jun. 1978 43 p

(Contracts EG-77-C-01-4049; EG-77-C-01-2522)

(SOLAR/2005-78/50) Avail: NTIS HC A03/MF A01

A summary is given of the Iris Images, Inc. solar installation. The solar energy is used to heat photographic process water in a commercial photo-processing laboratory located in Mill Valley, California. The two collector banks are mounted on the flat roof of the building with a total aperture area of 640 square feet. Both of the collector banks were site fabricated. The absorber plates for one bank are aluminum, as manufactured by Sunbrust Solar Energy, Inc. The other absorber plates are copper and were manufactured by Solar Development, Inc. Copper tubing is used for the fluid passages in both collectors. Auxiliary heating of the process water is provided by a gas fired storage type water heater. The solar system has been fully instrumented for data acquisition and is included in the National Solar Data Network. DOE

N79-24487# Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
PRELIMINARY LONG-TERM STABILITY CRITERIA FOR COMPRESSED AIR ENERGY STORAGE CAVERNS IN SALT DOMES
R. L. Thoms and J. D. Martinez Aug. 1978 90 p refs
(Contract EY-76-C-06-1830)
(PNL-2871) Avail: NTIS HC A05/MF A01

A methodology for determining the long-term stability of site specific compressed air energy storage cavern systems in salt domes is presented. Results of a literature survey are given. DOE

N79-24488# General Electric Co., Schenectady, N. Y.
EVALUATION OF A FLYWHEEL-POWERED SHUTTLE CAR Final Technical Report as of 25 Aug. 1978
P. H. Boucheron, Dallas E. Cain, and Alan S. Rubenstein Aug. 1978 335 p
(Contract ET-77-C-01-8890)
(FE-8890) Avail: NTIS HC A15/MF A01

The practical application of flywheel-stored energy devices to shuttle cars in underground coal minning was evaluated along with practical methods of charging, recovery, and transmitting flywheel energy so as to provide power for the necessary functions of a shuttle car. The general conclusions indicate that the mine mission requirements can be fulfilled with a flywheel energy storage system which can be designed within the present state-of-the-art, that a flywheel system can yield sufficient economic benefits to warrant a mine demonstration, and that there is promise of safety improvements due to elimination of the trailing cable presently used. In addition, it is indicated that specific operation problems associated with a flywheel-powered vehicle, like emergency movement of the vehicle and transmission of energy from the wayside to the vehicle, can be satisfactorily solved. DOE

N79-24489# Oak Ridge National Lab., Tenn. Energy Div.
ECONOMETRIC-ENGINEERING ANALYSIS OF FEDERAL ENERGY CONSERVATION PROGRAMS IN THE COMMERCIAL SECTOR
Jerry R. Jackson Jan. 1979 41 p refs
(Contract W-7405-eng-26)
(ORNL/CON-30) Avail: NTIS HC A03/MF A01

The energy savings and capital cost consequencies of four commercial sector conservation programs are reported. The effects of these programs are evaluated using an econometric engineering model of commercial energy use. A baseline projection is developed as the first step in the analysis to determine energy use in the absence of conservation programs. Each conservation program is then evaluated independently and in combination with all other programs. A scenario is developed that removes the effects of market imperfections such as lack of information and institutional barriers. This perfect-market scenario provides an estimate of the maximum conservation potential in the commercial sector. DOE

N79-24490# Department of Energy, Washington, D. C.
ENERGY MATERIALS COORDINATING COMMITTEE (EMACC) Annual Report, fiscal year 1978
1978 75 p refs
(Contract W-7405-eng-48)
(DOE/US-002) Avail: NTIS HC A04/MF A01

Activities in energy-related materials research are presented by members of the DOE Energy Materials Coordinating Committee. DOE

N79-24491# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
THERMOELECTROCHEMICAL CYCLES FOR POWER AND HYDROGEN PRODUCTION
M. Steinberg 1978 21 p refs Presented at the 2d World Hydrogen Energy Conf., Zurich, 21-24 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24387; Conf-780807-12) Avail: NTIS HC A02/MF A01

A power cycle for converting thermal to electrical energy is presented. The cycle is referred to as the thermoelectrochemical (TEC) power cycle. The general principle involves combing the electrochemical decomposition of a compound to its elements at a condition where the free energy change is low with the recombination of the same or a different compound from its elements at a condition where the free energy change is high. The difference in free energies gives a net difference in electromotive force which results in a net power output for the system. The power combines the operation of an electrolyzer at a high temperature low emf condition, with a fuel cell at a low temperature high emf condition. The thermal energy is used to provide the high level heat in the electrolyzer while the low level heat is rejected in the fuel cell. Heat is thus converted to dc electricity. Ideal power cycle efficiencies are equal to the Carnot efficiency for non-condensing systems. DOE

N79-24492# Brookhaven National Lab., Upton, N. Y.
HYDROGEN HALOGEN ENERGY STORAGE SYSTEM
P. M. Spaziante (Oronzio de Nora Impianti Elettrochimici S.P.A, Milano, Italy), G. C. Sioli (Oronzio de Nora Impianti Elettrochimici S.P.A., Milano, Italy), R. Trotta (Oronzio de Nora Impianti Elettrochimici S.P.A., Milano, Italy), A. Perego (Oronzio de Nora Impianti Elettrochimici S.P.A. Milano, Italy), and James McBreen 1978 14 p Presented at Chem. Hydrogen Energy Systems Contracts Rev., Washington, D. C., 28 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-25212; Conf-781142-3) Avail: NTIS HC A02/MF A01

The hydrogen/chlorine energy storage system was considered for large scale energy storage. In FY1978 work included an assessment of system safety and cost, investigations of cell performance under conditions elevated pressure and temperature, determination of the transport properties of Nafion membranes and electrochemical engineering studies. Results are summarized. DOE

N79-24493# Energy Systems International, McLean, Va.
SOLAR ENERGY COMMERCIALIZATION FOR EUROPEAN COUNTRIES, VOLUME 2
Dec. 1978 96 p
(Contract EM-78-C-01-4250)
(HCP/CS-4250-Vol-2) Avail: NTIS HC A05/MF A01

Information was provided for U.S. International Commercialization Planning in the following areas: (1) solar activities and plans of countries visited, (2) near term applications in each country, (3) U.S. export potential in each country, and (4) international cooperation opportunities. The communications infrastructure among all organizations contacted whether U.S. or foreign was developed. Country summaries are provided as an overview of each country visited. DOE

N79-24494# International Business Machines Corp., Huntsville, Ala.
SOLAR PROJECT COST REPORT. IRIS IMAGES, INCORPORATED, FILM LABORATORY, MILL VALLEY, CALIFORNIA
9 Jun. 1978 33 p
(Contracts W-31-109-eng-38; FG-77-C-01-4049)
(SOLAR/2005-78/60) Avail: NTIS HC A03/MF A01

The solar energy system which provides preheated process water used for photographic film processing is described. The construction costs of this solar water heating project are presented. Categorical system costs are broken down into materials, direct labor, and subcontract costs where available. DOE

N79-24495# International Business Machines Corp., Huntsville, Ala.
SOLAR PROJECT COST REPORT. ARATEX SERVICES, INC., INDUSTRIAL LAUNDRY, FRESNO, CALIFORNIA
7 Jun. 1978 35 p
(Contracts W-31-109-eng-38; EG-77-C-01-4049)
(SOLAR/2008-78/60) Avail: NTIS HC A03/MF A01

The solar energy system is used in conjunction with a system which recovers heat from laundry wastewater and steam condensate. The construction costs of this solar water heating system are presented. Category costs are listed by materials, labor, and subcontract costs. DOE

N79-24496# International Business Machines Corp., Huntsville, Ala.
SOLAR PROJECT DESCRIPTION. RADIAN CORPORATION

OFFICE BUILDING, AUSTIN, TEXAS
2 May 1978 45 p
(Contracts EG-77-C-01-4049; EG-77-C-01-2522)
(SOLAR/2002-78/50) Avail: NTIS HC A03/MF A01

The system utilizes 36 concentrating collectors which provide an effective aperature area of 350 square feet. The collectors are ganged in two banks on the flat roof of the building. An aluminum angle support structure tilts the collectors toward the south and the collectors track the sun for east to west through the day. A tracking mechanism is provided for each of the two banks of collectors. A water/glycol mixture is pumped from the collectors to a counter flow heat exchanger between the collectors and the storage tank. The 1500 gallon insulated, fiberglass storage tank is located above ground on a concrete pad near the building. The cooling equipment for the system is a 3-ton packaged absorption air-cooler located on the second floor of the building and a cooling tower on the roof. DOE

N79-24497# International Business Machines Corp., Huntsville, Ala.
EFFECTS OF AIR DAMPER LEAKS ON SOLAR ENERGY SYSTEM PERFORMANCE
15 Sep. 1978 39 p
(Contract EG-77-C-01-4049)
(SOLAR/0012-78/29) Avail: NTIS HC A03/MF A01

The performance of several instrumented solar energy demonstration systems which use air as the energy transport medium was analyzed as part of the National Solar Data Program. Air dampers in all systems were found to leak from 12 to 40 percent of full flow. The investigation into the causes of the leaks is described. An analysis of the potential impact of these leaks on solar energy system performance is presented. Conclusions based on the results of the analysis are given. In the analysis, the impact on system performance was found to be potentially significant. Therefore a set of preventive measures regarding air damper leaks is included. DOE

N79-24498# International Business Machines Corp., Huntsville, Ala.
SOLAR PROJECT DESCRIPTION. TERRELL E. MOSELEY OFFICE BUILDING, LYNCHBURG, VIRGINIA
17 May 1977 48 p
(Contracts EG-77-C-01-4049; EG-77-C-01-255)
(SOLAR/2011-78/50) Avail: NTIS HC A03/MF A01

A summary is given of the Terrell E. Moseley, Inc. Office Building solar installation. The solar energy system for a one story office building in Lynchburg, Virginia, preheats domestic hot water and heats 1780 square feet of occupied space. The 400 square foot collector array was fabricated in a single bank on the roof of the adjoining warehouse to the solar-conditioned offices. The aluminum absorber plate, painted flat back, is mechanically fastened to a manifolded copper tubing. A thermal mastic is used to improve heat transfer properties between the absorber plate and the tubing. A single glazing of tempered glass covers the absorber plate. The collector back is insulated with a 4 inch thick fiberglass batt. The collector array is mounted on a wooden framing. A 2000 gallon steel storage tank, covered with fiberglass insulation, is located in the warehouse adjoining the solar-conditioned offices. The performance evaluation was integrated into the National Solar Data Network. DOE

N79-24499# International Business Machines Corp., Huntsville, Ala.
SOLAR PROJECT DESCRIPTION. KALWALL CORPORATION WAREHOUSE, MANCHESTER, NEW HAMPSHIRE
31 May 1978 34 p
(Contracts EG-77-C-01-4049; EG-77-C-01-2522)
(SOLAR/2015-78/50) Avail: NTIS HC A03/MF A01

A summary is given of the Kalwall Corporation's solar heated warehouse demonstration project. The direct gain passive solar system was retrofitted to a 10,000 square foot warehouse section in Manchester, New Hampshire. The design used 1750 square feet of Kalwall Corporation's sunwall solar window as the south wall collector aperture. The warehouse's concrete slab floor and inventories provide thermal storage. Five 24- inch thermostatically controlled fans are used for heat circulation. Auxiliary heat is provided by two space heaters supplied by hot water from an oilfire boiler. The solar system was fully instrumented for data acquisition and is included in the National Solar Data Network. DOE

N79-24500# Planning Research Center, McLean, Va.
APPLICATION AND SYSTEM DESIGN STUDY FOR COST-EFFECTIVE SOLAR PHOTOVOLTAIC SYSTEMS AT FEDERAL INSTALLATIONS Preliminary Report
Nov. 1978 70 p
(Contract EG-77-C-01-2522)
(HCP/CS-0306) Avail: NTIS HC A04/MF A01

The Department of Energy was charged with working cooperatively with other Federal agencies to assess the potential for the use of photovoltaic energy systems in the Federal community. An idenitification of the potential sites and uses of solar photovoltaic systems at Federal agencies was made. It was concluded that there is a market for life-cycle cost effective photovoltaic applications within the Federal community for both immediate use, and into the intermediate and projected future. Analysis of the results of the preliminary survey for the cost-effective applications for photovoltaic power systems within the Federal community presented, indicated that there are approximately $10 to $20 million (total installed costs) of photovoltaic applications that can be installed immediately after completion of system and structural designs. DOE

N79-24501# SOLCOST Service Center, Fort Collins, Colo.
SOLCOST: SPACE HEATING HANDBOOK WITH SERVICE HOT WATER AND HEAT LOADS CALCULATIONS
Jul. 1978 25 p
(Contract EX-76-C-01-2531)
(DOE/CS-0042/3) Avail: NTIS HC A02/MF A01

The SOLCOST is a simplified design method for residential and light commercial solar heating and cooling as well as solar hot water systems. It features heat load calculations, solar vs. conventional cost comparison and solar system sizing. Examples using the system are shown. DOE

N79-24502# Swedish Council for Building Research, Stockholm.
SWEDISH SOLAR ENERGY PROJECTS, 1978
B. Bergqvist and J. G. Holmberg 1978 159 p refs
(SIB-D-13-1978) Avail: NTIS (US Sales Only) HC A08/MF A01; ERDA Depository Libraries

This report presents 99 separate solar energy projects divided into: 37 projects on buildings with solar heating systems; 9 projects on outdoor swimming pools with solar heating systems; 6 projects on solar heating systems with seasonal storage; 7 research projects on the prerequisites for solar heating in Sweden; 33 research projects on the prerequisites for systems, methods, and components; 7 solar electricity projects. The report also includes presentations of 17 different solar collectors which are available in Sweden. A brief presentation of governmental organizations for support in the Swedish solar energy field is given. DOE

N79-24503# California Univ., Livermore. Lawrence Livermore Lab.
GENERAL-PURPOSE ALUMINUM-AIR/FLYWHEEL ELECTRIC VEHICLES
J. F. Cooper and E. Behrin 1 Nov. 1978 28 p refs Presented at Fall Meeting of the Electrochem. Soc., Pittsburgh, Pa., Oct. 1978
(Contract W-7405-eng-48)
(UCRL-82003; Conf-7810135-1) Avail: NTIS HC A03/MF A01

Design parameters and optimum operating conditions were determined for aluminum-air/flywheel vehicles with performances equivalent to that of a five-passenger highway automobile. The performance of such vehicles depends strongly on the voltage-current characteristics of aluminum-air cells and the weight of the reactants. The weight of cell hardware constitutes about 5% of the vehicle weight. The weight of the power cell (including reactants and electrolyte) is about 15% of the vehicle gross weight. The total energy cost of propulsion for the aluminum-air vehicle is approximately equal to that of an internal-combustion-engine vehicle of equivalent performance if the primary energy resource in both cases is coal. DOE

N79-24504# Brookhaven National Lab., Upton, N. Y.
GENERAL-EQUILIBRIUM APPROACH TO ENERGY/ ENVIRONMENTAL ECONOMIC ANALYSIS
Paul J. Groncki Aug. 1978 23 p refs Presented at the 1978 Ann. Meeting of the Allied Social Sci. Assoc., Chicago, Ill., 29 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24781; Conf-780861-1) Avail: NTIS HC A02/MF A01

A brief critique of the use of fixed-coefficient input-output models for use in energy/environment systems is presented. Given the existence of aggregate, general-equilibrium, variable coefficient growth models, a methodology is presented for using this information to adjust a recent disaggregated input-output table. The methodology takes into account all of the general equilibrium aspects of the aggregate model in making the changes in the disaggregate model. The use of various weighting schemes and the implicit technological change biases they embody are examined. The methodology is tested on historical tables for the United States, and preliminary results are discussed. The methodology's ability to fully capture the general-equilibrium nature of the economy should enhance the usefulness of input-ouput models in energy/environment modeling systems. DOE

N79-24505# Mound Lab., Miamisburg, Ohio.
CHEMICAL AND OPTICAL STUDIES OF HEAT TRANSFER FLUIDS CONTAINING SOLAR ENERGY ABSORBERS
Aaron R. Burke, Claude R. Hudgens, and Layton J. Wittenberg 1978 13 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979
(Contract EY-76-C-04-0053)
(MLM-2549(OP); Conf-790405-4) Avail: NTIS HC A02/MF A01

Quantitative measurements were made of the increase in absorptivity of the fluids to dissolved chromophoric materials. The heat transfer fluids chosen for this study had the following properties: liquid at ambient temperature, transparent to most of the solar spectrum, and low vapor pressure above the boiling point of water. Such liquids are generally commercially available organic and inorganic heat transfer fluids with potential application to mid-range solar thermal devices. Only chromophoric materials were considered which were soluble in the liquid. DOE

N79-24506# Northwestern Univ., Evanston, Ill.
BASIC RESEARCH ON CERAMIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEM Progress Report, 1 Dec. 1977 - 30 Nov. 1978
Donald H. Whitmore Dec. 1978 26 p refs
(Contract EY-76-S-02-2564)
(COO-2564-4) Avail: NTIS HC A03/MF A01

Experimental probes are used for measuring the movement of ionic and electronic charge carriers in ceramic materials suitable for solid electrolyte and electrode applications in high-performance secondary battery and fuel cell systems. Special emphasis is placed on developing a better understanding of the effects of structure, impurities and composition on charge carrier transport mechanisms in such materials and detailed knowledge of the kinetics and mechanism of reaction occurring (on a microscopic scale) at the electrode-electrolyte interfaces of energy storage and conversion systems. DOE

N79-24507# California Univ., Berkeley. Lawrence Berkeley Lab.
HYDROCARBONS AND ENERGY FROM PLANTS
Esther K. Nemethy, John W. Otvos, and Melvin Calvin Nov. 1978 10 p refs Presented at Workshop on Biomass Energy and Technol., Santa Clara, Calif., 8-9 Nov. 1978
(Contract W-7405-eng-48)
(LBL-8596; Conf-7811119-1) Avail: NTIS HC A02/MF A01

To explore the feasibility of obtaining fuels and chemical feedstocks by extraction of reduced photosynthetic materials from latex-bearing plants, field studies were undertaken in the cultivation and harvesting of Euphorbia lathyrus, a shrub that grows wild in the California climate. Preliminary results with wild seed and without the benefit of optimization of fertilizer and irrigation conditions gave an annual crop yield of about 12 dry tons per acre. Continuing agronomic studies are suggested for improving this yield. Reduced photosynthate can be extracted with various solvents from the plant material to the extent of 8.7 percent of dry plant weight. The extract is a complex mixture, averaging between 400 and 500 in molecular weight. DOE

N79-24508# Argonne National Lab., Ill.
DESIGN OF OPTIMUM COMPRESSED AIR ENERGY STORAGE SYSTEMS
A. Sharma (Ill. Univ. at Chicago Circle), F. W. Ahrens, K. M. Ragsdell (Purdue Univ.), R. K. Ahluwalia, and H. H. Chik (Ill. Univ. at Chicago Circle) 1978 43 p refs Presented at 1978 Midwestern Energy Conf., Chicago, 19-21 Nov. 1978
(Contract W-31-109-eng-38)
(CONF-7811101-1) Avail: NTIS HC A03/MF A01

Compressed air energy storage (CAES) power systems are considered by electric utilities for load-leveling application. Their economic benefit and the extent of premium fuel conservation is dependent on their design. An optimum design approach for CAES is presented. it is based on decomposition of the overall CAES plant/utility grid system into three partially-decoupled sub-systems. Technical and economic models of the subsystems are used in a constrained optimization procedure. The constraints are imposed by the physical characteristics of the subsystems, by interaction among the subsystems and by the interfacing requirements imposed by the utility. To illustrate the concepts, models for the subsystem comprising the compressor train, piping, and an aquifer reservoir was used in the optimization procedure. Results show that substantial reductions in capital cost and total operating cost can be achieved using optimization techniques. DOE

N79-24509# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
METHOD FOR THE COMPARATIVE ECONOMIC ASSESSMENT OF ENERGY STORAGE SYSTEMS
H. Davitian and R. W. Leigh Nov. 1978 18 p refs Presented at Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-25291; Conf-7810142-1) Avail: NTIS HC A02/MF A01

A method for the comparative economic evaluation of various energy storage devices in a given application is outlined. The method is used in examining the economics of devices with short lifetimes and can be employed whenever a device lifetime can be expressed as a function of physical parameters which are related to the manner in which the device is used. The economic consequences of changes in lifetime result from the dependence of the capital recovery factor on device lifetime. It is shown how analyses can be made of changes in technical performance characteristics or changes in the pattern of use of the storage device to determine their effects upon the annual cost of energy storage and to determine minimum cost systems. DOE

N79-24510# Sandia Labs., Albuquerque, N. Mex.
RESEARCH AT SANDIA LABORATORIES FOR SOLAR THERMAL LARGE POWER SYSTEMS PROGRAM Annual Summary, fiscal year 1978
Feb. 1979 60 p refs
(Contract EY-76-C-04-0700)
(SAND-78-8051) Avail: NTIS HC A04/MF A01

The technical activities performed at Sandia Laboratories in support of the Large Power systems portion of the Solar Thermal Power Program are summarized. Heliostat development, thermal storage research, receiver development, and system studies are described. DOE

N79-24511# Sandia Labs., Albuquerque, N. Mex.
PHOTOVOLTAIC CONCENTRATOR SYSTEM TECHNOLOGY AND APPLICATIONS EXPERIMENTS
E. L. Burgess 1979 10 p refs Presented at ASME Gas Turbine Closed-Cycle Sess., San Diego, Calif., 11 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2184; Conf-790305-2) Avail: NTIS HC A02/MF A01

Photovoltaic systems offer the potential of providing a significant portion of the nation's electrical energy needs by converting solar energy directly into electrical energy. The major

obstacle preventing this potential from being realized is the cost of photovoltaic systems. One approach to reducing system cost is to concentrate sunlight on the photovoltaic cells, increasing their output and hence, decreasing the amount of cell area required for a given power output. Technology is described and its future potential is discussed. Brief summaries of several concentrator applications experiments which are in the system design phase are presented. DOE

N79-24512# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
PERFORMANCE TESTING OF THE MCDONNELL DOUGLAS FRESNEL LENS SOLAR COLLECTOR
Vernon E. Dudley and Robert M. Workhoven Feb. 1979 31 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0625) Avail: NTIS HC A03/MF A01

The results of tests performed on the McDonnell Douglas Fresnel Lens rotating array solar collector at the Midtemperature Solar Systems test facility are summarized. Test objectives are defined, procedures are described, and conclusions are given. DOE

N79-24513# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
RELATIVE EFFECTIVE SOLAR SPACE HEATING OVER THE UNITED STATES OBTAINED FROM SOUTHWARD-TILTED SOLAR COLLECTORS
Walter H. Hoecker Nov. 1978 20 p refs
(PB-292963/6; NOAA-TM-ERL-ARL-73; NOAA-79020801) Avail: NTIS HC A02/MF A01 CSCL 10A

The distribution of relative effective solar space heating is displayed on maps of the contiguous United States for January and for the November through April heating maps are based on climatological data updated to 1978 and flat solar energy collectors tilted southward at angles of location latitude plus 10 degrees where average ground reflectivity is assumed. GRA

N79-24514# Wayne State Univ., Detroit, Mich.
CUPROUS OXIDE PHOTOVOLTAIC CELLS Final Report, 1 Oct. 1975 - 31 Mar. 1978
Dan Trivich, Edward Y. Wang, and Richard J. Komp Jul. 1978 75 p refs
(Grant NSF AER-75-23453)
(PB-290529/7; NSF/RA-780383) Avail: NTIS HC A04/MF A01 CSCL 10B

Schottky barrier front-wall Cu2O photovoltaic cells were prepared for the first time with different metals on isolated sheets of polycrystalline and single crystal Cu2O. The starting Cu2O material is prepared by heating sheet copper in air at 1000C. The polycrystalline Cu2O sheet can be converted into single crystal sheet by grain growth at 1070-1120C. Annealing at 500C improves the conductivity. After suitable etching and other surface treatment, the Cu2O sheet is coated with a thin film of metal by vacuum evaporation to produce the frontwall cell. A series of metal contacts were studied. A best cell of Cu/Cu2O under simulated sunlight gave a short-circuit current of 7 mA/sq cm, an open-circuit potential of 0.35 V and a fill factor of 0.45 for a conversion efficiency of 1.1%. From an analysis of the current-voltage curves, barrier heights were evaluated for the various metal/Cu2O junctions. GRA

N79-24515# Iowa Inst. of Hydraulic Research, Iowa City.
OPTIMUM COMBINATIONS OF COOLING ALTERNATIVES FOR STREAM-ELECTRIC POWER PLANTS, VOLUME 2 Final Report
Thomas E. Croley, Arthur R. Giaquinta, Rosa M.-H. Lee, and Tai-Dan Hsu Jul. 1978 185 p refs
(Contract DI-14-31-0001-5201)
(PB-290576/8; IIHR-212-Vol-2; W79-03662; OWRT-C-6011(5201)(3)-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 10B

Cooling alternatives and system thermodynamics are presented. Two sets of computer models are developed for the analysis through combination cooling systems. The models are used to study the thermal characteristics, economics, and water consumption of these combination cooling systems. The effects of both meteorological conditions and economic parameters such as various unit costs, were examined in the identification of optimum cooling system configurations for several case studies. The most promising cooling system configurations or types of combined coolin - systems, which are attractive in their economic or water conservation aspects were determined. It is found that the parallel water path configuration of the wet tower/cooling pond combination cooling system is economically superior to the series water path configurations. Finally, it is evident that combination wet lower/once-through cooling systems are economical in comparison with once-through cooling associated with low river heat assimilation capacity. GRA

N79-24516# Joint Center for Graduate Study, Richland, Wash. Solar Energy Lab.
INVESTIGATION OF LOW COST SOLAR CELLS BASED ON Cu2O Final Report, 1 Sep. 1975 - 30 Jan. 1978
Larry C. Olsen Sep. 1978 86 p refs
(Grant NSF AER-75-20501)
(PB-290940/6; NSF/RANN/AER75-20501/PR/78/1; NSF/RA-780381) Avail: NTIS HC A05/MF A01 CSCL 10B

Research conducted to investigate solar cells based on cuprous oxide is summarized. Cell studies were carried out with cuprous oxide substrates grown by complete oxidation of copper discs. Cuprous oxide grown in this manner is p-type with a resistivity in the range of 2000 to 4000 ohm-centimeters. An approach was developed for doping cuprous oxide with magnesium and chlorine to achieve material with a resisivity in the one to ten ohm-centimeter range. Frontwall cell structures studies included Schottky barriers, metal-insulator-semiconductor (MIS) devices and heterojunctions. Schottky barriers made with various metals essentially exhibit a barrier height of 0.7 to 0.9 eV. GRA

N79-24517# California Energy Commission, Sacramento.
FEASIBILITY AND ECONOMICS OF COGENERATION IN CALIFORNIA'S THERMAL ENHANCED OIL RECOVERY OPERATIONS Final Report
Dec. 1978 203 p refs
(PB-291794/6; CAEC-21) Avail: NTIS HC A10/MF A01 CSCL 10B

The large quantities of steam injected into oil wells to increase production by the process of thermal enhanced oil recovery (EOR) can also be used to generate electricity at some sites. Which California oil fields are suitable for cogeneration, the generation capacity possible, the appropriate fuel, and the economics of coal use for noncogeneration steam production at oil fields were determined. GRA

N79-24518# EIC, Inc., Newton, Mass.
ENERGY STORAGE WITH AMBIENT TEMPERATURE RECHARGEABLE LITHIUM BATTERIES Final Report, 1 Apr. 1975 - 31 Dec. 1977
S. B. Brummer, F. W. Dampier, V. R. Koch, R. D. Rauh, and T. F. Reise Jan. 1978 284 p refs
(Grant NSF AER-75-03779)
(PB-290934/9; NSF/RA-780382) Avail: NTIS HC A13/MF A01 CSCL 10C

An ambient temperature rechargeable lithium battery with characteristics suitable for load-levelling and electric vehicle applications was developed. The battery was to use an organic electrolyte and a dissolved depolarizer. Transition metal depolarizers were studied. Their major problem was excessive self-discharge. The depolarizer of choice is lithium/polysulfide, which is very soluble and discharges and recharges readily. Its self-discharge reaction with lithium is slow and leads to soluble lower polysulfides. The initial problems of this system which operates a little above room temperature (approximately 50 C) were moderate rate capability and modest recharging of the lithium electrode. Improvements in the cycling performance were in large part due to the development and refinement of techniques for the preparation of high purity electrolyte. GRA

N79-24519# California Energy Commission, Sacramento.
INVENTORY OF UNDERGROUND ENERGY STORAGE SITES IN CALIFORNIA Final Staff Report
Melissa Ann Jones Oct. 1978 99 p refs
(PB-290835/8; CAEC-32) Avail: NTIS HC A05/MF A01 CSCL 10A

Compressed air and pumped hydropower, heat from solar

thermal systems, and natural gas and petroleum products can be stored underground; Gas fields, oil fields, saline aquifiers, hard rock sites, caves and abandoned mines with minimum storage volumes of five million cubic feet and maximum depths of 3,500 feet are identified as potential energy storage sites. Data collected on compressed air energy storage sites in California is included and supplemented by information on California oil and gas fields. The information given for each site includes: the site name, location, depth to storage medium, volume, rock type, rock thickness, permeability, porosity, pressure containment capacity, and distance to transmission facilities, pipelines and geologic hazards. GRA

N79-24520# Geiringer (Paul L.) and Associates, Roslyn, N. Y.
COMMUNITY APPLICATION OF INTEGRATED ENERGY/ UTILITY SYSTEMS
Oct. 1978 34 p refs Sponsored in part by NBS and DOE
(Contract DHEW-100-77-0014)
(PB-290675/8) Avail: NTIS HC A03/MF A01 CSCL 13A

Sufficient information is provided for prospective Integrated Energy Utility System (IEUS) participants to determine the feasibility of an IEUS project that would fit their specific needs. Past studies made at the University of Florida and Central Michigan are summarized and the Burlington, Vermont study is examined in detail for lessons learned and recommendations on how to design and implement a successful IEUS project. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-24521 British Library Lending Div., Boston Spa (England).
METHOD FOR DETERMINING POLYCYCLIC AROMATIC HYDROCARBONS (PAH) AND PHENOLS IN EXHAUST GAS CONDENSATES USING THIN-LAYER FLUORIMETRY AND UV SPECTROSCOPY
Djahangir Taghizadeh Kaschani Apr. 1979 26 p refs Transl. into ENGLISH of conf. paper from Deutsche Gesellscaft fuer Mineralwissenschaft und Kohlechemie, West Germany Presented at 4th DGMK Specialists Meeting, Cologne, 5-7 Oct. 1977 p 158-175
(BLL-RTS-11654) Avail: British Library Lending Div., Boston Spa, Engl.

A simple and rapidly working thin-layer fluorometric method for the detection of polycyclic aromatic hydrocarbons (PAH) in exhaust gas condensates is described. After concentration by extraction and separation using thin-layer chromatography the PAH are identified and owing to their intensive and characteristic fluorescence at specific excitation and emission wavelengths, their amount is directly detected by fluorimetry. This method allows the detection of benzo(a)pyrene, benzo(b)fluoranthene, anthanthrene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene and perylene with good repeatability. The content of total phenols is determined by a rapid UV spectroscopic method. G.Y.

N79-24522# United Research Services, San Mateo, Calif.
PROTECTION, CLEANUP AND RESTORATION OF SALT MARSHES ENDANGERED BY OIL SPILLS: A PROCEDURAL MANUAL Final Report, Dec. 1974 - Dec. 1977
David J. Maiero, Robert W. Castle, and O. Leon Crain Nov. 1978 167 p refs
(Contract EPA-68-03-2160)
(PB-291958/7; URS-7004-05-01; EPA-600/7-78-220) Avail: NTIS HC A08/MF A01 CSCL 13B

Decision making criteria are provided for both the protection and cleanup. Special attention is given to the cleanup phase which involves foot and vehicular traffic in the marsh and which may lead to serious adverse impacts. The user is presented with criteria for termination of activities for both protection and cleanup activities. Recovery includes evaluation of the need for restoration versus natural recovery, and restoration techniques. GRA

N79-24523# Argonne National Lab., Ill.
NUMERICAL STUDY OF THE EFFECTS OF COMPLEX TERRAIN ON DYNAMICS OF AIRFLOW AND POLLUTION DISPERSION
Tetsuji Yamada 15 Jan. 1979 6 p refs Presented at 4th Symp. on Turbulence, Diffusion and Air Pollution, Reno, Nev., 15-18 Jan. 1979
(Contract W-31-109-eng-38)
(CONF-790101-4) Avail: NTIS HC A02/MF A01

A three-dimensional numerical model developed to simulate an airflow over complex terrain was extended to simulate a pollutant dispersion over the same topographic condition. The pollutant is considered to be passive and nonreactive. Dilution of pollutants due to the vertical motion resulting from divergence and convergence of the horizontal wind over the rugged terrain is an item of major interest. A pollutant advected through the inflow boundary experiences the greatest reduction in concentration (by approximately 50 percent) in the region directly above the downslope of the mountain. This is mainly due to mixing with clean air which is transported downward by subsidence. Concentration in the surface layer downwind of the mountain is considerably greater for the unstable case than for the stable case. This is due to the fact that higher concentrations in the layer directly above have been transported downward by turbulent mixing. DOE

N79-24524# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
LAND APPLICATION STUDIES OF INDUSTRIAL WASTE OILS AND SOLVENTS
J. R. Watts, K. W. McLeod (Georgia Univ.), and J. C. Gorey 1978 18 p Presented to Am. Soc. of Agronomy, Chicago, 4 Dec. 1978
(Contracts EY-76-C-09-0001; EY-76-C-09-0819)
(DP-MS-78-55; Conf-781242-1) Avail: NTIS HC A02/MF A01

Waste oil was applied to 12 of 24 soil plots and mixed thoroughly into the top 15 cm of soil. Four fertilizer levels were applied and the plots were tilled for aeration at two and nine months after the oil was applied. Soil core samples, taken at three-month intervals, show negligible vertical migration of oil and a steady decline in oil content of the soil. One year after initial application, microbial activity was six times as great on the sites which had oil applied as on adjacent control sites without oil. Oil biodegradation was not affected by the fertilizer levels. By the summer of 1977, approximately 50 percent of the applied oil was lost from the soil profile through biodegradation or volatilization indicating an annual loss rate of approximately 15,000 kg/ha. Plant growth on the oil treated plots was negligible in 1975, was restricted in 1976, and productivity of a crabgrass community showed no significant difference in 1977 between oil and nonoil plots. Almost all of the vegetation was crabgrass (Digitaria sanguinalis) on the oil plots. DOE

N79-24525# Stockholm Univ. (Sweden). Dept. of Meteorology.
SOME EXAMPLES OF TOTAL AEROSOL WEIGHT ACCOUNTED FOR BY MAJOR INORGANIC SOLUBLE COMPOUNDS
Andreas Richter and Lennart Granat 3 May 1978 15 p Sponsored in part by Swed. Natl. Environ. Protection Board Prepared in cooperation with Intern. Meteorol. Inst., Stockholm
(Grant SWED-NSRC-G-0223-06)
(AC-46) Avail: NTIS HC A02/MF A01

The dry deposition of aerosols was investigated in order to determine the relation between aerosol weight and chemical composition with regard to eight macro constituents. Aerosol samples were collected in a rural area in Sweden. Sulfate was found to be the dominating compound, contributing about 30 percent to the total bulk aerosol weight. Author (ESA)

N79-24526# Environmental Protection Agency, Research Triangle Park, N.C.
VISIBLE EMISSIONS EVALUATION, AIR POLLUTION TRAINING COURSE 439: INSTRUCTOR MANUAL Final Report
Sep. 1978 175 p Prepared by Northrop Serv., Inc., Research Triangle Park, N. C. 2 Vol.
(Contract EPA-68-02-0048)
(PB-291860/5; EPA-450/3-78-105) Avail: NTIS HC A08/MF A01 CSCL 13B

The manual is to be used by instructors or teachers who are conducting classes on how to evaluate (read) visible emissions to the atmosphere from air pollution sources. It includes everything the instructor needs when used with the student's manual. Topics covered include course and lesson objectives; lesson plans; quizzes; instructions on operation of the 'smoke' generator for black and white smoke; instructions on how to conduct the training course; and methods for evaluation of student performance. Sources of other needed items (films; slides; Ringelmann charts, etc.) are given. GRA

N79-24527# Environmental Protection Agency, Research Triangle Park, N.C.
VISIBLE EMISSIONS EVALUATION, AIR POLLUTION TRAINING COURSE 439: STUDENT MANUAL Final Report
Sep. 1978 231 p refs Prepared by Northrop Serv., Inc., Research Triangle Park, N. C. 2 Vol.
(Contract EPA-68-02-2374)
(PB-291861/3; EPA-450/3-78-106) Avail: NTIS HC A11/MF A01 CSCL 13B

The manual is to be used by students who are learning how to evaluate (read) visible emissions to the atmosphere from air pollution sources. Both black, grey, and white plumes are covered. The manual discusses sources of air pollution and describes visible emissions to be expected and the reasons why such may occur. A brief review of meteorological phenomena affecting stack plume behavior is given. Practices and procedures to be used in evaluating visible emissions of both the black/grey and other color nature are described in detail. The Ringelmann chart and its use are discussed. Equipment for generating visible emissions to be observed in training observers is described in detail. GRA

N79-24528# Environmental Protection Agency, Seattle, Wash. Surveillance and Analysis Div.
CARBON MONOXIDE STUDY, SEATTLE, WASHINGTON, PART 1 Executive Summary Report, 6 Oct. - 2 Nov. 1977
C. B. Wilson and J. W. Schweiss Dec. 1978 40 p refs
(PB-290505/7; EPA-910/9-78-054A) Avail: NTIS HC A03/MF A01 CSCL 13B

A 20-day study involving 36 outdoor sites, five indoor sites, and two pedestrian walking routes was conducted in downtown Seattle in order to obtain additional information on the magnitude and spatial of the CO problem, evaluate the effectiveness of existing monitors in the business district, and aid in the selection of candidate sites for routine monitoring. Data obtained from air samples are summarized in bar charts of the measurement distribution for each site and each day of the study period, in histogram-maps showing the spatial distribution of the CO, and in tables. Results from the study sites were compared with data from the permanent monitors, and show that the CO problem is not restricted to the immediate vicinity of the permanent monitors in the downtown commercial district. GRA

N79-24529# Environmental Protection Agency, Seattle, Wash. Surveillance and Analysis Div.
CARBON MONOXIDE STUDY, SEATTLE, WASHINGTON, PART 2 Final Report, 6 Oct. - 2 Nov. 1977
C. B. Wilson and J. W. Schweiss Dec. 1978 169 p refs
(PB-290506/5; EPA-910/9-78-054B) Avail: NTIS HC A08/MF A01 CSCL 13B

Bag samples were analyzed by an electrochemical oxidation method. Results for one eight-hour period daily (two consecutive four-hour samples) were compared for the outdoor study sites and for five routinely operated permanent monitors in the central business district. The permanent monitoring netwoek adequately represented the highest eight-hour average CO concentration measured during the study period (about 16 ppm), but not the highest frequency of exceedences of the 9.0 ppm standard (80% of the days at one study site). The carbon monoxide problem occurred throughout the downtown commercial district with excesses noted at least once at 22 of the study sites. Indoor CO concentrations were usually lower than at adjacent outdoor sites. Changes in average indoor and outdoor levels of CO frequently coincided. Methods and findings are discussed and tables of data obtained are included. GRA

N79-24530# Eastern Environmental Radiation Lab., Montgomery, Ala.
A RADIOLOGICAL ENVIRONS STUDY AT A FUEL FABRICATION FACILITY Final Report
R. J. Lyon, R. L. Shearin, and J. A. Broadway Oct. 1978 118 p refs
(PB-291928/0; EPA-520/5-77-004) Avail: NTIS HC A06/MF A01 CSCL 06E

The facility chosen for the study was operating continuously using the ammonium diuranate process to convert 2.0 to 2.2% enriched UF6 to UO2 fuel. Environmental uranium from plant effluents was distinguished from naturally occurring uranium by using specific isotopic analyses and statistical interpretations. Continuous air samplers at five sites measured the concentrations of U-234 and U-238 in air for 36 one week intervals. River water was sampled at nine locations above and below the plant discharge point during each of three surveys. GRA

N79-24531# Systems Applications, Inc., San Rafael, Calif.
MODELING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS, VOLUME 1 Interim Report, Jul. 1976 - Jul. 1978
G. Z. Whitten, H. Hogo, M. J. Meldgin, J. P. Killus, and P. J. Bekowies Jan. 1979 332 p refs 2 Vol.
(Contract EPA-68-02-2428)
(PB-290507/3; EPA-600/3-79-001A-Vol-1; EF78-121A-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 07E

Computer modeling of smog chamber data is discussed. A series of chemical mechanisms were developed to describe the photochemical formation of ozone from nitrogen oxides and organic compounds. A kinetic scheme intended for use in models simulating the formation of ozone in urban atmospheres was refined. The mechanism includes a condensed version of the mechanisms developed, plus a semi-empirical scheme to describe the oxidation of aromatic hydrocarbons. The effects of smog chambers on ozone formation were examined. GRA

N79-24532# Systems Applications, Inc., San Rafael, Calif.
MODELLING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS. VOLUME 2: APPENDIX Interim Report, Jul. 1976 - 1978
G. Z. Whitten, H. Hogo, M. J. Meldgin, J. P. Killus, and P. J. Bekowies Jan. 1979 415 p 2 Vol.
(Contract EPA-68-02-2428)
(PB-290508/1; EPA-600/3-79-001B-Vol-2; EF78-121B-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 07E

A series of detailed chemical mechanisms were developed to describe the photochemical formation of ozone from nitrogen oxides and the following organic compounds (alone and in various combinations): formaldehyde, acetaldehyde, ethylene, propylene, butane, 1-butene, trans-2-butene, and 2,3-dimethylbutane. A generalized kinetic scheme intended for use in models simulating the formation of ozone in urban atmospheres was refined. The effects of smog chambers on ozone formation were examined. The main chamber effects identified thus far are apparently due to nitrogen oxides degassing from the walls during experiments and differences between chambers in the spectral distribution of ultraviolet irradiation. GRA

N79-24533# Calspan Corp., Buffalo, N. Y.
LABORATORY INVESTIGATION OF THE PHOTOOXIDATION AND CATALYTIC OXIDATION OF SO2 Final Report
R. J. Anderson, R. J. Pilie, E. J. Mack, and W. C. Kocmond Jan. 1979 88 p refs
(Contract EPA-68-02-1785)
(PB-290859/8; CALSPAN-NA-5781-M-1; EPA-600/3-79-006) Avail: NTIS HC A05/MF A01 CSCL 07E

The photooxidation of SO2 in irradiated auto exhaust + SO2 systems, the catalytic oxidation of SO2 in the solution droplets of hazes, clouds and fogs containing several concentrations of heavy metals Mn(+2) and Fe(+3), and the oxidation of SO2 in irradiated hazes and fogs containing only trace quantities of heavy metals were studied in a 590 cu m indoor smog chamber. For the irridated auto exhaust + SO2 systems, SO2 oxidation rates as high as 5 percent/hr were observed. Catalytic oxidation of SO2 in fogs and hazes was significant under certain conditions. No synergistic effect on the rate of SO2 oxidation

was observed from the simultaneous presence of irradiation and a fog or haze. GRA

N79-24534# TRW, Inc., Durham, N. C.
DEMONSTRATION OF WELLMAN-LORD/ALLIED CHEMICAL FGD TECHNOLOGY: ACCEPTANCE TEST RESULTS
R. C. Adams, S. J. Lutz, and S. W. Mulligan Jan. 1979 129 p refs
(Contract EPA-68-02-1877)
(PB-290514/9; EPA-600/7-79-014A) Avail: NTIS HC A07/MF A01 CSCL 13A

Process performance guarantees were met or exceeded. During the 12-day Design Load test, the plant was operated at the design condition of a boiler flue gas output rate equivalent to 80 percent of the maximum boiler load of 115 MW gross. During the 83-hour High Load test, the plant treated flue gas volumes equivalent to 95 percent of maximum boiler load. SO2 removal of 90 percent or better was achieved. Particulate emissions did not exceed 0.1 lb/million Btu of boiler heat input. The consumption of steam, natural gas, and electrical power was less than the performance guarantee requirements at Design Load conditions. Soda ash consumption was less than the limit set by the performance guarantees. Finally, sulfur product purity was greater than 99.5 percent. GRA

N79-24535# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENERGY/ENVIRONMENT 3: PROCEEDINGS OF THE 3RD NATIONAL CONFERENCE ON THE INTERAGENCY R AND D PROGRAM
Oct. 1978 363 p refs Conf. held at Washington, D. C., 1-2 Jun. 1978
(Contract EPA-68-01-2934)
(PB-290558/6; EPA-600/9-78-022) Avail: NTIS HC A16/MF A01 CSCL 13B

Energy/Environment 3 provides an update of Interagency research programs in particular areas, including health effects, transport processes and ecological effects, mining methods and reclamation, control technology and integrated technology assessment. Complete texts of all papers are presented, along with addresses, panel discussions, and question and answer periods. GRA

N79-24536# Maine Univ., Orono.
EFFECT OF SOIL MOISTURE CONTENT UPON ADSORPTION AND MOVEMENT OF PHOSPHORUS FROM LEACHATES OF DOMESTIC WASTE DISPOSAL SYSTEMS M.S. Thesis
Thomas G. McNeice Aug. 1978 78 p refs
(PB-290561/0; W79-03683; OWRT-A-044-ME(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Physical principles of porous media flow were used to establish functional relationships between hydraulic properties of an Adams soil. Soil columns simulating septic tank adsorption fields were used in conjunction with the hydraulic property data to investigate effect of soil moisture content upon the adsorption and movement of phosphorus. Experimental tests were employed to determine other factors such as pH and organic matter content specific to the Adams soil, which could effect phosphorus retention. It was demonstrated that the effect of reducing the level of saturation in a soil is to greatly increase the amount of phosphorus adsorbed and thereby limit the depth of penetration. GRA

N79-24537# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL OF VOLATILE ORGANIC EMISSIONS FROM PETROLEUM LIQUID STORAGE IN EXTERNAL FLOATING ROOF TANKS
Richard K. Burr, Kerri C. Brothers, and Jack G. Wright Dec. 1978 64 p refs
(PB-290579/2; EPA-450/2-078-047; OAQPS-1.2-116) Avail: NTIS HC A04/MF A01 CSCL 13B

The necessary guidance for development of regulations limiting emissions of volatile organic compounds (VOC) from storage of petroleum liquids in external floating roof tanks is presented in this report. Reasonably available control technology (RACT) is defined in this document; cost analysis for RACT is included for evaluating the cost effectiveness of controlling external floating roof tank sources. GRA

N79-24538# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
URBAN WATER RESOURCES POLICY ALTERNATIVES: A SOCIOLOGICAL ANALYSIS OF DIFFERENTIAL PERSPECTIVES
Harry R. Potter, Anne K. Taylor, and Gary M. Grossman Dec. 1978 43 p refs
(Contract DI-14-31-0001-5213)
(PB-290583/4; PWRRC-TR-106; W79-03660; OWRT-C-6106(5213)(7)) Avail: NTIS HC A03/MF A01 CSCL 13B

The acceptability to community leaders and the general public of selected urban water resources policy alternatives was examined. The orientation is methodological; using the survey method, question are deliberately varied in generality specificity, and comparisons are made on the effect of experience with water problems and location of residence (urban, transitional rural)on acceptability of alternative solutions. Data are from personal interviews with 46 leaders and a sample of 139 other residents of Tippecanoe County, Indiana. More specific question were ask demands produced greater indications of concern wit the environment and water pollution. Respondents expressed considerable concern over two drainage alternatives, retention basins and open ditches, whether they had direct experience with them or not. They also expressed a strong belief in citizen participation and a preference for local government involvement in policy decisions. GRA

N79-24539# Radian Corp., Austin, Tex.
OZONE/ULTRAVIOLET RADIATION MONITORING Final Report
Jun. 1978 29 p
(PB-290594/1; RAD-78-100-170-03; HAOS-11) Avail: NTIS HC A03/MF A01 CSCL 13B

A total of 3,248 hours of ozone data and 2,891 hours of ultraviolet radiation data were collected. The highest hourly ozone avaerage was 307 parts per billion (ppb) and was observed on July 13 from 1700 to 1800. The second highest hourly average was 255 ppb and was observed for hours 1600 to 1700 and 1800 to 1900 on July 13. A one-hour average of 80 ppb ozone was attained or exceeded for at least one hour in each of 44 days. The peak ultraviolet radiation levels observed were four langleys. GRA

N79-24540# Southern Research Inst., Birmingham, Ala.
SAMPLING CHARGED PARTICLES WITH CASCADE IMPACTORS Final Report, Apr. 1977 - Sep. 1978
W. E. Farthing, D. H. Hussey, W. B. Smith, and R. R. Wilson, Jr. Jan. 1979 90 p refs
(Contract EPA-68-02-2131)
(PB-290897/8; SORI-EAS-79-024; EPA-600/7-79-027) Avail: NTIS HC A05/MF A01 CSCL 13B

Experiments which demonstrate that a cascade impactor sampling a charged aerosol may yield a particle size distribution measurement that deviates from the time distribution are discussed. The distributions indicated more large particles and fewer small particles than actually existed, due to the particles' attraction to the grounded impactor plates (stages). Although higher charge levels produced larger deviations from the true size distribution, the magnitude of the deviation and the corresponding correction factor for any given charged aerosol are unpredictable. Also, the error was smaller if glass fiber substrates were used as collection surfaces instead of bare metal. For electrostatic precipitators operating at normal charging conditions the size distribution was not significantly different from the true size distribution. GRA

N79-24541# Illinois Inst. of Natural Resources, Chicago.
THE ECONOMIC IMPACT ANALYSIS OF EFFLUENT STANDARDS FOR TOTAL DISSOLVED SOLIDS
Linda L. Huff Oct. 1978 94 p refs
(PB-290916/6; IINR-78/12) Avail: NTIS HC A05/MF A01 CSCL 13B

Elimination of the present total dissolved solids effluent standard in Illinois was recommended. The present effluent

standard prohibits an increase of more than 750 mg/l above the background concentration, except where resulting from waste treatment or recycle. The elimination of this standard would benefit potable water treatment plants, electric generating stations, and industrial discharger. Reduction of expenses is regarded as the chief benefit. GRA

N79-24542# Oklahoma State Univ., Stillwater. Dept. of Biological Sciences.
ROLE OF INORGANIC CARBON AVAILABILITY IN THE FORMATION OF NUISANCE BLOOMS OF BLUE-GREEN ALGAE Final Technical Completion Report
James D. Ownby 1978 19 p refs
(Contract DI-14-34-0001-8038)
(PB-290716/0; W79-03762; OWRT-A-077-OKLA(1)) Avail: NTIS HC A02/MF A01 CSCL 06F

Availability of inorganic carbon in the form of CO2 suggested as a limiting factor in the growth of phytoplankton under conditions of high pH. The effects of pH and bicarbonate alkalinity on growth of the blue-green alga Anabaena variabilis and the green alga Scenedesmus obliquus were measured under laboratory conditions. Although both organisms has an initial high growth rate, Anabaena exhibited longer sustained growth which was enhanced by high pH and high bicarbonate alkalinity. These results appear consistent with the hypothesis that blue-green algae are better able to compete for inorganic carbon under these conditions. In the presence of bicarbonate, the growth of both algae caused an alkalinization of the medium by 1.2 to 2.6 pH units, which is attributed to the uptake of bicarbonate, its conversion to CO2, and the subsequent release of OH(-)into the growth medium. A radiometric assay was developed to measure carbonic anhydrase activity in phytoplankton. GRA

N79-24543# Denver Research Inst., Colo.
BALLOON-BORNE PARTICULATE SAMPLING FOR MONITORING POWER PLANT EMISSIONS Final Report, Nov. 1976 - Jul. 1978
J. A. Armstrong, P. A. Russell, and R. E. Williams Oct. 1978 60 p refs
(Grant EPA-R-804829)
(PB-290473/8; EPA-600/7-78-205) Avail: NTIS HC A04/MF A01 CSCL 14B

A light weight remote-controlled sensor sampler, carried aloft by a tethered balloon, that was developed to collect particulates from the plumes of fossil fuel power plants at various downwind distances, is presented. The airborne sampler is controlled from the ground by a radio transmitter and receiver/servo system. The sampler system was field tested at two sites burning low-sulfur coal, an urban and a rural power plant. The collected samples were analyzed in terms of size, concentration, and composition using scanning electron microscopy/energy dispersive X-ray spectrometry. In general, the particles were spheres with diameters less than 5 micrometers. Some agglomerates were found. Most of the fly ash was composed of Si and Al, with small amounts of Fe. GRA

N79-24544# Spectron Development Labs., Inc., Costa Mesa, Calif.
EXAMINATION OF AUTOMATIC DATA REDUCTION METHODS FOR PARTICLE FIELD HOLOGRAMS Final Report, Mar. 1977 - Jan. 1978
J. D. Trollinger Jan. 1979 61 p refs
(Contract EPA-68-02-2491)
(PB-290909/1; EPA-600/2-79-005) Avail: NTIS HC A04/MF A01 CSCL 14B

The feasibility of using existing electro-optic image analyzers to automatically analyze three-dimensional image fields is examined and what modifications of existing equipment would be required to construct such a system is determined. Sample holograms as well as holograms produced in an actual field holocamera were used to make the evaluations experimentally, and well-refined analytical descriptions of holographic images were used to add to the understanding of system requirements. The study established that existing image analyzers are capable within useful practical limits of locating particle images in three-dimensions and measuring size and shape factors of the particle. A plan for integrating such equipment to produce a fully automated data reduction system is presented. GRA

N79-24545# Resources for the Future, Inc., Washington, D. C.
AN ANALYSIS OF AIR POLLUTION AND ITS HEALTH EFFECTS: WASHINGTON, D. C. METROPOLITAN AREA Final Report, 1973 - 1974
Eugene P. Seskin Feb. 1979 78 p refs
(Contract EPA-68-03-2415)
(PB-290618/8; EPA-600/5-79-002) Avail: NTIS HC A05/MF A01 CSCL 06F

The impact of additional air pollution and weather data on conclusions drawn from an earlier study analyzing some acute health effects of air pollution in the Washington, D. C. metropolitan area was studied. Statistical models were formulated to test the hypothesis that air pollution can aggravate the health status of a population and can result in increased utilization of certain types of medical care services. The statistical results indicate that air pollution levels have a very limited effect on the health-care utilization of the group practice even after the additional air pollution and meteorological data were examined. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-24546 Utah Univ., Salt Lake City.
A PRIMITIVE EQUATION SPECTRAL MODEL FOR THE STUDY OF STRATOSPHERIC SUDDEN WARMINGS Ph.D. Thesis
Nicholas James Lordi 1978 183 p
Avail: Univ. Microfilms Order No. 7909392

A model applied to four cases of stratospheric warmings simulated by forcing at the tropopause is presented. Two cases of wavenumber one forcing are performed, one allowing wave-wave interaction as well as wave-mean flow interaction and the other allowing only wave-mean flow interaction. A similar pair of cases is performed for wavenumber two forcing. In all cases the model is integrated to 30 days. It was concluded that stratospheric warming is due to the dominance of eddy heat flux convergence; whereas the polar mesospheric cooling observed during all model integrations is due to the dominance of adiabatic cooling through induced mean vertical motions, initiated in the polar stratosphere. Dissert. Abstr.

N79-24547 Princeton Univ., N. J.
THE ATMOSPHERIC CIRCULATION AROUND ANTARCTICA: LINEAR STABILITY AND FINITE AMPLITUDE INTERACTIONS WITH THE MID-LATITUDES OF THE SOUTHERN HEMISPHERE Ph.D. Thesis
Carlos Roberto Mechoso 1979 183 p
Avail: Univ. Microfilms Order No. 7910122

Observations indicate the presence of strong westerly winds in the troposphere over the coast of Antarctica. The linear stability of these westerlies is studied by using a semispectral numerical model with which the linearized shallow anelastic, hydrostatic equations are integrated. The influence on the instability of both the slopes and the amplitude of an orography taken as representative of East Antarctica is analyzed. The results obtained for several mean flows taken as idealizations of possible mean states indicate that, although the topography exerts a somewhat stabilizing influence, the time that small perturbations take to double their amplitudes is less than two days in all cases. It is concluded that the circulation around Antarctica is linearly unstable and that its instability is strong enough that cyclogenesis around the continent may be expected. Dissert. Abstr.

N79-24548 New Hampshire Univ., Durham.
COLLISIONLESS EVOLUTION OF THE AURORAL ELECTRON VELOCITY DISTRIBUTION FUNCTION Ph.D. Thesis
James Dean Rickman, Jr. 1978 220 p
Avail: Univ. Microfilms Order No. 7909308

The time evolution of the electron velocity distribution function determined by the collisionless Boltzmann equation is calculated in one dimension (one space and one velocity dimension) and 2 1/2 dimensions (two space and three velocity).

The calculations assume a cold stationary background of ions and a spatially varying electron density that gives rise to an electrostatic electric field calculated from the Poisson's equation. The one dimensional computer calculation gives the correct results for Landau damping of a high initial electric field and the two-stream instability. The 2 1/2 dimensional calculation is tested for Landau damping of parallel and 45 degree plasma waves and shown to give the correct results. Dissert. Abstr.

N79-24549 California Univ., San Diego.
IONSPHERIC ELECTRODYNAMICS AND ITS COUPLING TO THE MAGNETOSPHERE Ph.D. Thesis
Naresh Chandulal Mehta 1979 346 p
Avail: Univ. Microfilms Order No. 7909824

The Chatanika measurements of the latitude distributions of the F-region perpendicular ionospheric electric field and of the E-region height-integrated ionospheric Pedersen and Hall conductivities are presented. A brief discussion of the current coupling between the ionosphere and the magnetosphere including an equivalent electrical circuit, is presented and emphasizes the importance of ionospheric conductivities in the overall electrodynamics. A conceptually simple boundary value problem in ionospheric electrodynamics is treated. A discussion of the magnetospheric electrodynamics inferred from the Chatanika measurements of the ionospheric electric fields is also presented. Dissert. Abstr.

N79-24550 California Univ., Riverside.
DISTRIBUTION OF POSITIVE ION SPECIES ABOVE A DIFFUSE MIDNIGHT AURORA Ph.D. Thesis
Thomas Earle Moore 1978 150 p
Avail: Univ. Microfilms Order No. 7911462

The origin of the hot plasma in the Earth's magnetosphere is still open to investigation due to the incompleteness of the knowledge about particle transport across its boundaries. One method of approaching this problem observationally is by performing mass discriminating measurements of the ion distribution functions. An instrument was developed for this purpose and flown via sounding rocket above a diffuse midnight aurora during geomagnetically quiet conditions. The instrument combines wide mass and energy ranges (1 to 200 amu and 250 eV to 12 keV), high mass resolution with good sensitivity, and superior rejection of undesired particles. Only ions identified as H(+) and He(2+) were detected, and the He(2+) was statistically marginal, having an upper limit of two to four percent of the H(+) intensity. All other ions including the ionospheric species He(+) and O(+) were absent above a similar level. Dissert. Abstr.

N79-24551 State Univ. of New York at Albany.
ION-MOLECULE INTERACTIONS OF ATMOSPHERIC IMPORTANCE Ph.D. Thesis
Lo Yin Chan 1978 235 p
Avail: Univ. Microfilms Order No. 7911186

A systematic study of the various processes leading to the formation of ion clusters is presented. Their nature, size and relative importance in the atmosphere are examined through model studies as well as limited laboratory experiments with simulated atmospheres. The work involves laboratory experiments, the development of an ion-molecule kinetic model to simulate ion evolution, and the development of a heteromolecular-ion nucleation model to explain ion-induced aerosol formation. The quality of the experiments was improved by upgrading the plasma-chromatograph mass-spectrometer system. Spectrum analysis techniques were also developed as well as procedures for establishing reaction schemes for ion-molecule reactions of a mixture of trace gases in the atmosphere. Dissert. Abstr.

N79-24552 New Hampshire Univ., Durham.
CONVECTIVE ELECTRIC FIELD MEASUREMENTS IN AN AURORAL PLASMA Ph.D. Thesis
Lawrence Joseph Zanetti, Jr. 1978 165 p
Avail: Univ. Microfilms Order No. 7909432

NASA flights 18:1005 and 18:1004 were launched from Andoya Rocket Range in January and February 1977, sampling respectively quiet and break-up auroral conditions. On board were multiple detectors sampling the 0-5 eV ion spectrum. A least squares fit of an altered Maxwellian to the data results in the ion bulk flow velocity, temperature and density and the rocket potential. In addition, one detector was a low resolution mass spectrometer capable of separating O(+) from NO(+). The electric field results are compared with the dual probe experiment, also on board. The first flight traversed a quiet pre-midnight arc to the north. Conductivities were evaluated given the accompanying high energy electron data. From these values and the electric fields, the horizontal current systems were calculated. Dissert. Abstr.

N79-24553 Oklahoma Univ., Norman.
A TWO-DIMENSIONAL NUMERICAL SIMULATION OF THE DRY LINE ENVIRONMENT AND ITS ROLE IN THE DEVELOPMENT OF MESOSCALE CONVECTIVE SYSTEMS Ph.D. Thesis
Lihsiung Aron Chang 1979 172 p
Avail: Univ. Microfilms Order No. 7911143

The mesoscale boundary layer model was constructed using a stretched horizontal grid system and a terrain-following vertical coordinate. Different forcing conditions were diagnosed. Vertical turbulent mixing was shown to be responsible for the daytime eastward motion of the dryline. Horizontal advection and horizontal mixing accounted for the nocturnal return of the surface dry line. Kinematic and thermodynamic fields in the simulated dry line environment were also examined. The divergence field and vertical motion were distributed such that there existed a favorable condition for the release of potential instability and hence the possible onset of moist convection in close proximity to the dry line. Limitations of this numerical model are discussed and several suggestions for future research of dry line affected mesoscale convective systems are also given. Dissert. Abstr.

N79-24554 California Univ., Los Angeles.
DEVELOPMENT OF PREFERRED ORIENTATION IN UNIAXIALLY DEFORMED OLIVINE AGGREGATES Ph.D. Thesis
Gerald Lee Dollinger 1978 208 p
Avail: Univ. Microfilms Order No. 7907649

Two sets of uniaxial compression experiments were run on olivine aggregates to determine the nature of the preferred orientation that develops during deformation over a wide range of temperatures. In the first set, powdered dunite samples were deformed at 25 C to 1200 C to determine the nature of the preferred orientation that develops during syntectonic recrystallization. In the second set, synthetic dunite samples were deformed at 800 C to 1200 C to determine the nature of the preferred orientation that develops under plastic deformation conditions. The origin of the preferred orientation in recrystallized samples is explained by selective recrystallization of grains or nuclei with high resolved shear stress on their slip systems during deformation. Evidence from the synthetic dunite samples indicates that only grains with (010) normal to the compression direction remain undeformed during deformation. Dissert. Abstr.

N79-24555 Texas A&M Univ., College Station.
PHYSICAL PROPERTIES OF SEDIMENTS FROM THE CONTINENTAL MARGIN OF WESTERN AFRICA Ph.D. Thesis
William Edward Hottman 1978 138 p
Avail: Univ. Microfilms Order No. 7909204

After initial build up of the west African continental margin, sedimentation was predominantly biogenic. The physical properties of the sediments from this area are generally related to rock type and follow the general trends of increasing density, increasing sonic velocity and decreasing porosity with depth except where abrupt lithologic changes are encountered. Physical properties data suggested that significant amounts of overburden were removed from portions of the Cape Basins and the Walvis Ridge. At a site in the cape Basin results of consolidation testing suggests that approximately 130 meters of overburden are removed. Dissert. Abstr.

N79-24556 Texas Univ. at Austin.
TYPES OF KARST, WITH EMPHASIS ON COVER BEDS IN THEIR CLASSIFICATION AND DEVELOPMENT Ph.D. Thesis
James Francis Quinlan, Jr. 1978 342 p
Avail: Univ. Microfilms Order No. 7911014

A description of the interpretation of karst landscapes is

presented. Karst is classified according to eight major attributes: cover, rock type, climate, geological structure, physiography, hydrology, modifications during or after karstification, and dominant landforms. Some karst landscapes are described as well as the hydration of anhydrite to gypsum. Dissert. Abstr.

N79-24557 California Inst. of Tech., Pasadena.
GENERALIZED RAY MODELS OF STRONG GROUND MOTION Ph.D. Thesis
Thomas Harrison Heaton 1978 304 p
Avail: Univ. Microfilms Order No. 7906211

A method for synthesizing local ground displacement from a model consisting of a finite fault located within a layered halfspace is demonstrated. The response of a three-dimensional fault is evaluated by integrating the responses of point shear dislocations over the fault plane (Green's function technique). The response of each point shear dislocation is evaluated by using generalized ray theory in conjunction with the Cagniard-de Hoop technique. Dissert. Abstr.

N79-24558 California Inst. of Tech., Pasadena.
A METHOD FOR WAVEFORM INVERSION OF BODY-WAVE SEISMOGRAMS Ph.D. Thesis
George Robert Mellman 1979 121 p
Avail: Univ. Microfilms Order No. 7911628

An iterative inversion method was developed for the determination of velocity depth structure and the estimation of seismic source parameters using the waveforms of far field body wave seismograms. The inversion is accomplished by minimizing an error function that expresses the different between data and synthetic seismogram. This error function is constructed insensitive to absolute amplitudes and travel-times, and is a measure of wave-form errors only. In the case where earth structure is assumed known and the source parameters are to be determined, the source is represented as a small number of point shear dislocations. Estimates are obtained of relative seismic moment, depth, fault orientation, source time function, and relative location for each point dislocation. The inversion method developed is applied to the study of the Borrego Mountain earthquake. Dissert. Abstr.

N79-24559 Connecticut Univ., Storrs.
DETERMINATION OF EARTHQUAKE SOURCE CHARACTERISTICS BY COMPUTER SIMULATION OF TELESEISMIC P-WAVE PULSES Ph.D. Thesis
Paul Richard Ogushwitz 1978 134 p
Avail: Univ. Microfilms Order No. 7911397

A parametric study in which an earthquake fault is modeled as a line of discrete point-sources is described. Fracture propagation is simulated by successive excitation of the generators according to geometric, kinematic, and dynamic parameters. Each time a generator triggers, it releases a wavelet whose detected characteristics (shape, amplitude, and time duration) can be specified. Synthetic seismograms are developed at arbitrary positions relative to the fault line by superimposing such wavelets. The azimuthal variation of pulse-shapes decreased with a decrease in the ratio of rupture velocity to P-wave velocity. Pulse-shapes varied symmetrically about the perpendicular bisector of the fault. Dissert. Abstr.

N79-24560 Texas Univ. at Austin.
MARINE MAGNETIC ANOMALIES FROM THE WESTERN AND NORTHERN PHILIPPINE SEA: IMPLICATIONS FOR THE EVOLUTION OF MARGINAL BASINS Ph.D. Thesis
Tai-chang Shih 1978 190 p
Avail: Univ. Microfilms Order No. 7911026

A set of processed data is presented together with all available magnetic anomaly data from the West Philippine Basin and the Shikoku Basin. The combined data allows the lineation patterns in these basins to be deduced and the tectonic history of the Philippine Sea to be determined. The correlations indicate that the crust of the West Philippine Basin started to form before anomaly 25 time (approximately 59 m.y. B.P.), probably at the ridge which was the southern boundary of the Pacific plate at that time. The West Philippine margin basin, however, was formed at about 40 m.y. B.P., after the entrapment of oceanic crust by transform faults which changed into subduction boundaries. Dissert. Abstr.

N79-24561 Southern Methodist Univ., Dallas, Tex.
SUBSURFACE TEMPERATURES FROM SURFACE HEAT FLOW DATA USING EQUIVALENT PLANE SOURCES Ph.D. Thesis
John Lisle Steele 1978 186 p
Avail: Univ. Microfilms Order No. 7911214

An analytical equivalent source function in the form of a continuous finite plane conductive heat source is developed from the instantaneous point source temperature equation. Heat source solutions to the surface heat flow equations are solved in terms of the inverse technique. An equivalent finite plane heat source is used to create pseudo-information representative of complex thermal systems and to estimate the thermal regime. The thermal structure is created on the assumption of a homogeneous conductive halfspace and that the anomalous surface heat flow represents the effect of the subsurface thermal field. Comparison of an equivalent plane heat source thermal field to a finite difference solution shows temperature results within 3% of the finite difference solution. Dissert. Abstr.

N79-24562 California Univ., Riverside.
SPATIAL CHARACTERISTICS OF NET RADIATION AND ITS COMPONENTS FOR ONTARIO Ph.D. Thesis
Gerald Oscar Tapper 1978 238 p
Avail: Univ. Microfilms Order No. 7911763

The Budyko Method as outlined and presented is an effective way of obtaining values for net radiation and its various components which are reasonable and provide an accurate representation of actual patterns of these components. The method is not perfect and requires some modification to improve the model, especially in terms of the data which are used in the model. The principal area for improvement is in the calculation of net longwave radiation. Applying the calculated net radiation values for determining the elements of the hydrologic cycle, via the Lettau Triplet, creates a useful device for planning resource development. Once determined, the runoff, dryness ratios, and evaporation can infer potential regions for agriculture in those regions of Ontario on the developed margins of the province. Dissert. Abstr.

N79-24563 British Library Lending Div., Boston Spa (England).
ON THE QUANTUM MECHANICAL THEORY OF BALL LIGHTNING
Neugebauer Tibor 28 Nov. 1978 24 p refs Transl. into ENGLISH of ITP-Budapest Report no. 352, from Roland Eoetvoes Univ., Aug. 1975 24 p
(BLL-CTO/1560-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

After a critical analysis of the results of observations and theories on ball lightning, it is shown that the only acceptable theory of this phenomenon is that ball lightning consists of an almost completely ionized plasma sphere floating like a soap bubble, that it is an independent phenomenon. However, the sphere is ionized not in accordance with the Sahas equation because the temperature is much too low but because of the instantaneous accumulation of charge when a flash of streak lightning strikes. Calculations show that such a gas sphere can conserve the quantum mechanical exchange forces in the face of the thermal expansion tendency. It is shown that in terms of the delocalization of the electrons in our plasma sphere, in some cases relationships similar to those in a metal lattice may be found and calculations show that in this case the value of the recombination coefficient is reduced so substantially that our plasma drop can exist for several seconds in a type of metastable state. Author

N79-24564*# National Aeronautics and Space Administration, Washington, D. C.
GLOBAL DISTRIBUTION OF OZONE FOR VARIOUS SEASONS
L. I. Koprova May 1979 13 p refs Transl. into ENGLISH from the book "Interpretation and Util. of Satellite Data in Weather Analysis" Leningrad, Gidrometeoizdat, 1978 p 94-100 Original language document was announced as A79-14638 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75435) Avail: NTIS HC A02/MF A01 CSCL 04A

A technique which was used to obtain a catalog of the seasonal global distribution of ozone is presented. The technique is based on the simultaneous use of 1964-1975 data on the total ozone content from a worldwide network of ozonometric stations and on the vertical ozone profile from ozone sounding stations. G.Y.

N79-24565*# National Aeronautics and Space Administration, Washington, D. C.

ANOMALY OF THE COMPOSITION OF THE F-2 EQUATORIAL REGION OF THE IONOSPHERE DURING THE HOURS AFTER SUNSET ACCORDING TO DATA FROM THE MASS-SPECTROMETER EXPERIMENT ON THE COSMOS-274

V. Yu. Gaydukov, V. G. Istomin, and Yu. A. Romanovskiy May 1979 18 p refs Transl. into ENGLISH of "Anomaliya Sostava Ekvatorialnoy Oblasti F-2 Ionosfery v Poslezakhodnyye Chasy po Dannym Mass-Spektrometricheskogo Eksperimenta na Sputnike Kosmos-274", Rept. PR-331 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 17 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-2790)

(NASA-TM-75615; PR-331) Avail: NTIS HC A02/MF A01 CSCL 04A

A mass spectrometer on board Cosmos-274 measured concentrations of light atoms and ions. While traversing the geomagnetic equator during the evening hours it recorded on anomalous drop in ionized molecular oxygen and ionized atomic oxygen and nitrogen. A similar, less dramatic, decline was observed in the concentration of neutral atomic oxygen. A possible explanation for this and previously observed behavior is an ascent in altitude of the F layer in the hours after sunset, a possibility which is supported by calculations. Author

N79-24566# Geophysical Observatory, Christchurch (New Zealand). Physics and Engineering Lab.

A SUITE OF PROGRAMS FOR HANDLING IONOSPHERIC DATA

L. A. Tomlinson Mar. 1979 50 p refs

(PEL-Report-628) Avail: NTIS HC A03/MF A01

Computer programs were developed to handle the work involved in the preparation of the ionospheric data sheets for publication. Reading the data, processing the data, and printing the results are discussed in the data preparation process. The three stages in the data preparation process are described; (1) data files, (2) published data sheets, and (3) data processing. S.E.S.

N79-24567*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

MIDDLE ATMOSPHERE PROJECT. A SEMI-SPECTRAL NUMERICAL MODEL FOR THE LARGE-SCALE STRATOSPHERIC CIRCULATION

James R. Holton and William Wehrbein May 1979 78 p refs (Grant NsG-2228)

(NASA-CR-158653; Rept-1) Avail: NTIS HC A05/MF A01 CSCL 04A

The complete model is a semispectral model in which the longitudinal dependence is represented by expansion in zonal harmonics while the latitude and height dependencies are represented by a finite difference grid. The model is based on the primitive equations in the log pressure coordinate system. The lower boundary of the model domain is set at the 100 mb level (i.e., near the tropopause) and the effects of tropospheric forcing are included in the lower boundary condition. The upper boundary is at approximately 96 km, and the latitudinal extent is either global or hemispheric. The basic differential equations and boundary conditions are outlined. The finite difference equations are described. The initial conditions are discussed and a sample calculation is presented. The FORTRAN code is given in the appendix. G.Y.

N79-24568*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ATMOS SPACELAB 1 SCIENCE INVESTIGATION Final Report, 1 May 1978 - 30 Apr. 1979

Jae H. Park (College of William and Mary), Mary Ann H. Smith (College of William and Mary), Jerold T. Twitty (Systems and Applied Services, Corp., Riverdale, Md.), and James M. Russell, III 30 Apr. 1979 19 p refs

(Grant NsG-1484)

(NASA-TM-80465) Avail: NTIS HC A02/MF A01 CSCL 04A

Existing infrared spectra from high speed interferometer balloon flights were analyzed and experimental analysis techniques applicable to similar data from the ATMOS experiment (Spacelab 3) were investigated. Specific techniques under investigation included line-by-line simulation of the spectra to aid in the identification of absorbing gases, simultaneous retrieval of pressure and temperature profiles using carefully chosen pairs of CO2 absorption lines, and the use of these pressures and temperatures in the retrieval of gas concentration profiles for many absorbing species. A search for a new absorption features was also carried out, and special attantion was given to identification of absorbing gases in spectral bandpass regions to be measured by the halogen occultation experiment. R.E.S.

N79-24569*# Illinois Univ., Urbana. Dept. of Electrical Engineering.

A ROCKET-BORNE ELECTROSTATIC ANALYZER FOR MEASUREMENT OF ENERGETIC PARTICLE FLUX

M. A. Pozzi, L. G. Smith, and H. D. Voss 1 Feb. 1979 107 p refs

(Grant NGR-14-005-181)

(NASA-CR-158646; ISSN-0568-0581; UILU-ENG-79-2501; Aeronomy-82) Avail: NTIS HC A06/MF A01 CSCL 04A

A rocket-borne electrostatic analyzer experiment is described. It is used to measure energetic particle flux (0.9 to 14 keV) in the nighttime midlatitude E region. Energetic particle precipitation is believed to be a significant nighttime ionization source, particularly during times of high geomagnetic activity. The experiment was designed for use in the payload of a Nike Apache sounding rocket. The electrostatic analyzer employs two cylindrical parallel plates subtending a central angle of 90 deg. The voltage waveform supplied to the plates is a series of steps synchronized to the spin of the payload during flight. Both positive and negative voltages are provided, extending the detection capabilities of the instrument to both electrons and protons (and positive ions). The development, construction and operation of the instrument is described together with a preliminary evaluation of its performance in a rocket flight. J.M.S.

N79-24570*# Illinois Univ., Urbana. Dept. of Electrical Engineering.

A ROCKET-BORNE PULSE-HEIGHT ANALYZER FOR ENERGETIC PARTICLE MEASUREMENTS

W. Leung, L. G. Smith, and H. D. Voss 1 Mar. 1979 97 p refs

(Grant NGR-14-005-181)

(NASA-CR-158645; ISSN-0568-0581; UILU-ENG-79-2502; Aeronomy-83) Avail: NTIS HC A05/MF A01 CSCL 04A

The pulse-height analyzer basically resembles a time-sharing multiplexing data-acquisition system which acquires analog data (from energetic particle spectrometers) and converts them into digital code. The PHA simultaneously acquires pulse-height information from the analog signals of the four input channels and sequentially multiplexes the digitized data to a microprocessor. The PHA together with the microprocessor form an on-board real-time data-manipulation system. The system processes data obtained during the rocket flight and reduces the amount of data to be sent back to the ground station. Consequently the data-reduction process for the rocket experiments is speeded up. By using a time-sharing technique, the throughput rate of the microprocessor is increased. Moreover, data from several particle spectrometers are manipulated to share one information channel; consequently, the TM capacity is increased. L.S.

N79-24571*# Illinois Univ., Urbana. Dept. of Electrical Engineering.

A ROCKET-BORNE DATA-MANIPULATION EXPERIMENT USING A MICROPROCESSOR

L. L. Davis, L. G. Smith, and H. D. Voss 1 Apr. 1979 112 p refs

(Grant NGR-14-005-181)

(NASA-CR-158647; UILU-ENG-79-2503; Aeronomy-84; ISSN-0568-0581) Avail: NTIS HC A06/MF A01 CSCL 04A

The development of a data-manipulation experiment using a Z-80 microprocessor is described. The instrumentation is included in the payloads of two Nike Apache sounding rockets used in an investigation of energetic particle fluxes. The data from an array of solid-state detectors and an electrostatic analyzer is processed to give the energy spectrum as a function of pitch angle. The experiment performed well in its first flight test: Nike Apache 14.543 was launched from Wallops Island at 2315 EST on 19 June 1978. The system was designed to be easily adaptable to other data-manipulation requirements and some suggestions for further development are included. L.S.

N79-24572*# Aerospace Corp., El Segundo, Calif.
AURORAL MAGNETOSPHERE-IONOSPHERE COUPLING: A BRIEF TOPICAL REVIEW
Y. T. Chiu, Michael Schulz, and J. M. Cornwall (California Univ., Los Angeles) 10 Apr. 1979 25 p refs
(Contract NASw-3120)
(NASA-CR-158662; ATR-79(9553)-7) Avail: NTIS HC A02/MF A01 CSCL 04A

Auroral arcs result from the acceleration and precipitation of magnetospheric plasma in narrow regions characterized by strong electric fields both perpendicular and parallel to the earth's magnetic field. The various mechanisms that were proposed for the origin of such strong electric fields are often complementary Such mechanisms include: (1) electrostatic double layers; (2) double reverse shock; (3) anomalous resistivity; (4) magnetic mirroring of hot plasma; and (5) mapping of the magnetospheric-convection electric field through an auroral discontinuity.
Author

N79-24573# Magnetic Observatory, Hermanus (South Africa).
STUDIES IN IONOSPHERIC RAY TRACING M.S. Thesis - Rhodes Univ.
Sheridan Lambert Apr. 1978 115 p refs
(CSIR-R-MAG-5/17) Avail: NTIS HC A06/MF A01

Ray tracing was used to analyze certain daytime ionograms recorded at Grahamstown, South Africa. A computer program which solves Haselgrove's equation was developed and used to trace rays in the frequency range 1 - 30 MHz. Vertical, short distance oblique, and long distance oblique ionograms were synthesized from the results and compared with vertical ionograms recorded at Grahamstown and oblique ionograms, transmitted from Alice, South Africa (distance 64 km) and SANEA, Antarctica (distance 4470 km) and received at Grahamstown. Ray paths were calculated and related in detail to the models of the ionosphere and the geomagnetic field. The main features of the vertical and short distance oblique ionograms can be reproduced using spherically stratified ionosphere models with electron density profiles derived from vertical ionograms. A suitable model for the geomagnetic field is a tilted dipole equivalent to the actual field at Grahamstown. The two-hop mode is shown to be the lowest encountered on the long distance oblique records in normal conditions. A.R.H.

N79-24574# Range Commanders Council, White Sands Missile Range, N. Mex. Electronic Trajectory Measurements Group.
ATMOSPHERIC REFRACTION MEASUREMENTS AND RELATED EFFORTS
Feb. 1979 37 p refs
(AD-A065766) Avail: NTIS HC A03/MF A01 CSCL 04/1

The ETMG task on refraction correction was originated with the optimistic goal of definitively dissecting the refraction problem, establishing those accomplishments which are possible and recommending equipments and techniques to be used for various situations. Since the atmosphere is a continually varying medium, even perfect measurements of refractivity in a given location may not be valid for a nearby region, and shortly after measurement will no longer be valid for the region measured. Rawinsonde or refractometer measurements typically involve the instrument being borne over a long distance during a considerable time period. The normal assumptions that the derived refractivity profile is both spherically symmetric and invariant in time undoubtedly introduce gross errors into any correction technique. It was decided to begin the refraction study by adopting the questionable symmetric and invariant assumptions, and assuming that the only error in making a correction for the refraction effect is introduced by errors in measurement of the refractivity profile. That profile measurement is assumed to be made by the most typically used instrument, the rawinsonde. If good results are possible under these assumptions, then the sensitivity to relaxation of the questionable assumptions could be made. GRA

N79-24575# New Mexico State Univ., Las Cruces. Dept. of Physics.
CALCULATION OF THERMAL EMISSION FROM AEROSOLS USING THE DOUBLING TECHNIQUE
August Miller, Richard C. Shirkey, and Mary Ann Seagraves Nov. 1978 74 p refs
(Contract DAEA18-77-C-0003; DA Proj. 1L1-61102-B-53A)
(AD-A065622; ERADCOM/ASL-TR-0020) Avail: NTIS HC A04/MF A01 CSCL 04/1

The doubling approach to numerically solving the equation of radiative transfer in a plane-parallel atmosphere is reviewed and extended to include thermal emissions from an ambient medium. The matrix method used is that of Barkstrom and Querfeld and employs the familiar S and T operators to construct a thermal emission operator, E. This new operator is not internally dependent upon the temperature of the layer under consideration, thereby providing a computationally fast method for producing atmospheric models in which thermal emission effects are included. The method is further extended to include the effects of the clear air layer below a cloud base and also the effects of emission from the planetary surface. A computer program using this method is described and results of studies of clouds and smoke are given. Author (GRA)

N79-24576# HSS, Inc., Bedford, Mass.
EOMET-77: ATMOSPHERIC TRANSMISSION VALUES DERIVED FROM PHOTOGRAPHS OF THE SEA HORIZON Final Report, 17 Jul. 1978 - 31 Jan. 1979
H. S. Stewart, M. P. Shuler, Jr., and L. B. Woolaver 28 Dec. 1978 69 p refs
(Contract N00173-78-C-0160)
(AD-A065942; HSS-B-049) Avail: NTIS HC A04/MF A01 CSCL 04/1

The end product of this report is a tabulation of aerosol scattering coefficients at three wavelengths obtained from color photographs of the horizon taken on twenty occasions during the 1977 cruise of the USNS Hayes. In addition, challenging photographs from ten occasions have been analyzed and the scattering coefficients obtained from them are compared with coefficients obtained from the corresponding most promising photographs. Pertinent supporting data are also presented. This includes date, time of day, latitude, longitude, wind direction, ship heading, and cloud type and cover. GRA

N79-24577# Emmanuel Coll., Boston, Mass.
STUDY AND ANALYSIS OF EQUATORIAL IRREGULARITIES, TOTAL ELECTRON CONTENT, AND SCINTILLATIONS Final Report, 1 Jul. 1975 - 30 Jun. 1978
Santimay Basu, Sunanda Basu, James Johanson, Eileen Mackenzie, and M. Patricia Hagan Oct. 1978 182 p refs
(Contract F19628-76-C-0003; AF Proj. 4643)
(AD-A065550; AFGL-TR-78-0263) Avail: NTIS HC A09/MF A01 CSCL 04/1

The following are among the topics studied. (1) The nature of electrojet irregularities responsible for daytime VHF scintillations in the equatorial region. The times of onset and decay of VHF scintillations are shown to correspond closely with the times of onset and decay of type 2 irregularities deflected by 50 MHz radar and E sub sq echoes on ionograms. (2) The spatial localization of nighttime irregularities detected by scintillation and VHF radar backscatter measurement; (3) The kilometer and meter scale irregularities in the night-time equatorial F-region giving rise to VHF-UHF scintillations and VHF radar backscatter; (4) Modelling of equatorial and high latitude scintillations using a large data base, and also the detailed, individual magnetic storm picture; (5) The variability of total electron content (TEC) as it limits the accuracy of satellite navigation and satellite detection radar systems as well as the correlation distance of TEC variability. The results of plasmaspheric electron content are presented and its importance in the determination of additional ionspheric group delay is assessed. GRA

N79-24578# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1978
Michael A. Chinnery 30 Sep. 1978 79 p refs
(Contract F19628-78-C-0002; ARPA Order 512)
(AD-A065574; ESD-TR-78-259) Avail: NTIS HC A05/MF A01 CSCL 08/11

This report describes 20 investigations in the fields of seismic discrimination and the analysis of data from a global seismic network. These are grouped as follows: the estimation of event location and focal depth (4 contributions), the estimation of the source moment tensor (5 contributions), miscellaneous studies (6 contributions), and computer systems and data collection (5 contributions). Author (GRA)

N79-24579# Argonne National Lab., Ill. Energy and Environmental Systems Div.
EMISSION DENSITY ZONING GUIDEBOOK. A TECHNICAL GUIDE TO MAINTAINING AIR QUALITY STANDARDS THROUGH LAND-USE-BASED EMISSION LIMITS Final Report
Norman F. Kron, Alan S. Cohen, Linda M. Mele, and Kathryn S. Macal, ed. Sep. 1978 322 p refs
(PB-290657/6; EPA-450/3-78-048) Avail: NTIS HC A14/MF A01 CSCL 04A

An emission density zoning (EDZ) regulation is an air pollution control strategy that is similar to traditional land use zoning in that EDZ controls air pollution by setting emission density limits (EDLs) for certain areas of land EDLs restrict the rate of pollutant emission per unit area. The step-by-step procedural guide was designed to help regional planning and air pollution control agencies set EDLs for sulfur dioxide and particulate matter within a metropolitan area. The EDLs, set through the use of a computer-assisted dispersion model and linear programming package, ensure the attainment and maintenance of the national ambient air quality standards and compliance with prevention of significant deterioration regulations. GRA

N79-24580# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
THE PHOTOELECTRON FLUX IN THE EARTH'S IONOSPHERE AT ENERGIES IN THE VICINITY OF PHOTOIONIZATION PEAKS Interim Scientific Report
John R. Jasperse (AFGL) and Ed R. Smith 17 Jul. 1978 6 p refs Repr. from Geophys. Res. Letters, v. 5, no. 10, Oct. 1978 p 843-846
(Contract F19628-77-c-0243)
(AD-A062310; AFGL-TR-78-0287; Paper-810870) Avail: NTIS HC A02/MF A01 CSCL 04/1

The Boltzmann-Fokker-Planck (BFP) theory is applied to analyze the (isotropic) photoelectron flux in the Earth's ionosphere at energies in the vicinity of photoionization where the electron impact cross sections are slowly varying functions of energy. A Green's function solution is given for the photoelectron flux which shows that the energy derivative terms in the BFP method dominate the solution in spectral regions on high slope. Analytical results are for the photoelectron flux and the forward and backward half widths in the vicinity of isolated photoionization are given which explain the observed asymmetry and shift of the photoionization peaks with increasing altitude. G.Y.

N79-24581# Air Force Geophysics Lab., Hanscom AFB, Mass.
A COMPARISON OF THEORETICAL AND EXPERIMENTAL RESULTS IN SUPERCOOLED STRATUS DISPERSAL Scientific Interim Report
Rosemary M. Dyer and Bruce A. Kunkel 9 Aug. 1978 22 p refs
(AF Proj. 6670)
(AD-A063013; AFGL-TR-78-0123) Avail: NTIS HC A02/MF A01 CSCL 04/1

A one dimensional mathematical model of the growth of ice crystals in supercooled clouds was examined in detail and a sensitivity analysis was performed. Critical parameters include seeding rate, temperature, cloud depth, liquid water content, drop size, and updraft velocities. Calculations were compared with experimental observations made during a stratus seeding field program conducted in Northern Michigan in 1977. Substituting reasonable values of cloud physics parameters and using known values of the seeding rates, minimum temperatures, and cloud depth, reasonable agreement between theoretical and observed rates of cloud dissipation was obtained. Author

N79-24582# Air Force Geophysics Lab., Hanscom AFB, Mass.
SPECTRAL RADIANCE OF SNOW AND CLOUDS IN THE NEAR INFRARED SPECTRAL REGION Final Report
Francis R. Valovcin Nov. 1978 46 p refs
(AD-A063761; AFGL-TR-78-0289; AFGL-AFSC-403) Avail: NTIS HC A03/MF A01 CSCL 17/5

The near infrared spectral radiance measurements of snow and cirrus and cumulus cloud backgrounds taken by the Air Force Geophysics Laboratory's flying laboratory are evaluated. From the analysis of the 124 spectra obtained, the spectral radiances or reflectance characteristics of snow and cirrus and cumulus clouds between 5500 and 7000/cm (1.82-1.43 micrometers were determined. Snow/cloud discrimination can be made by utilizing a sensor in the 5500 to 7000/cm spectral region. Based on the analysis of these data, certain snow/cloud design parameters were identified; that is, slope of the spectral radiance, absolute spectral and/or total radiance, and the location and value of the maximum spectral radiance for the snow and cirrus and cumulus cloud backgrounds. Finally, specific recommendations are made for an optimal operational snow/cloud discrimination radiometer. Author (GRA)

N79-24583# Airborne Research Associates, Weston, Mass.
SUMMARY OF AIRPLANE ELECTRIC FIELD MEASUREMENTS AS PART OF IONOSPHERIC ELECTRIC FIELD MAPPING INVESTIGATION, THOMPSON, MANITOBA, AUGUST 1978 Final Report
Ralph Markson 16 Mar. 1979 4 p refs
(Contract N00014-78-C-0500)
(AD-A066304) Avail: NTIS HC A02/MF A01 CSCL 04/1

Constant altitude measurements of the vertical electric field were made from an aircraft at about 10 km over periods of several hours in the vicinity of balloons drifting at constant altitudes making similar measurements at altitudes near 25 km. Comparison of the aircraft and balloon records will be used to verify the theory of mapping ionospheric electric fields downward into the atmosphere. Author (GRA)

N79-24584# Science Applications, Inc., Ann Arbor, Mich.
TUNED DIODE LASER MEASUREMENTS OF ATMOSPHERIC ABSORPTION PROFILES IN THE 4.5 MICROMETERS TO 5.0 MICROMETERS REGION Final Report, 23 May 1978 - 23 May 1978
David G. Snyder 23 May 1978 18 p refs
(Contract DAAG29-76-C-0050)
(AD-A066159; SAI-78-009-AA) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report describes results obtained from infrared spectra of H2O and CO2 in the 4.8 micrometers region taken with a tunable diode laser. For CO2, evidence is given for the inclusion of an additional term in the F-factor over that usually used in the case of the main 4.8 micrometers band. In the case of H2O, strength measurements are compared with the AFGL line parameters, as well as with calculations of Camy-Peyret and Flaud, with the present study supporting the latter. Limited data is also presented on investigations of line widths, self-to-foreign broadening coefficients and line shapes for water vapor. In addition to these results, a method is proposed which should enable the measurement of the far wing shape of a line without the need of considering overlap from other lines. GRA

N79-24585# Aeronautical Research Associates of Princeton, Inc., N. J.
SEASONAL VARIATIONS IN ULTRAVIOLET SINGLE SCATTERING PHASE FUNCTIONS Final Report
Joseph M. Schlupe, C. Robert Dickson, and Michael E. Neer Feb. 1979 266 p refs
(Contract N00014-76-C-1094)
(AD-A066160; ARAP-383) Avail: NTIS HC A12/MF A01 CSCL 04/1

Ultraviolet single scattering phase functions have been measured with a scanning polar nephelometer in a wide variety of weather conditions for rural, industrial, maritime, and desert atmospheres. Good correlation between measured phase functions

and those predicted from Mie and Rayleigh theory using measured aerosol particle size distributions was generally observed in the fall and winter months and in fogs. Measured phase functions generally exceeded predicted values in the spring and summer months because of inadequacies in either the particle size measurement technique or the representation of aerosol particles as spherical dielectrics. Attempts to verify the phase functions measured at scattering angles below ten degrees with variable field of view attenuation and scattering techniques were generally unsuccessful due to rapidly changing aerosol and ozone concentrations. An algorithm has been found for correlating the ultraviolet aerosol scattering coefficient with visibility.
Author (GRA)

N79-24586# Scott Polar Research Inst., Cambridge (England).
AN ANALYSIS OF ICE PROFILES OBTAINED BY SUBMARINE SONAR IN THE AIDJEX AREA OF THE BEAUFORT SEA Data Analysis and Presentation Report, period ending 1976
Raymond J. Horne Dec. 1978 68 p refs
(Contract N00014-78-G-003)
(AD-A066336; SPRI-TR-78-1) Avail: NTIS HC A04/MF A01 CSCL 17/1

A profile of the ice cover in the southern Beaufort Sea was obtained by the submarine USS GURNARD in April 1976, using a narrow-beam upward-looking sonar. The 1400 km profile consisted of three legs, of which the long south-north and east-west legs intersected near the Caribou camp of the AIDJEX experiment. A statistical analysis was carried out over contiguous 50 km sections to yield probability density functions of the drafts of ice and of level ice, distributions of keel spacings and drafts, and the frequencies and widths of leads. Two distinct types of ice cover were found. The first, nearest the coast in the south and west of the experimental area, consisted of heavily ridged ice with mean drafts of up to 5.1 m. The rest of the track (1200 km) consisted of a homogeneous ice cover with a mean draft of 3.7 m. The percentage of thin ice varied greatly between sections, with a range of 0.4 to 12.3% for ice of 0-1 m draft.
GRA

N79-24587# Northeastern Univ., Boston, Mass. Electronics Research Lab.
ELECTRONICS FOR A ROCKET BORNE QUADRUPOLE CLUSTER ION MASS FILTER Final Report, 1 Aug. 1976 - 31 Jul. 1978
J. Spencer Rochefort and Raimundas Sukys Oct. 1978 50 p refs
(Contract F19628-76-C-0256)
(AD-A066289; AFGL-TR-78-0292) Avail: NTIS HC A03/MF A01 CSCL 04/1

Electronic circuits have been developed to control a rocket borne quadrupole mass filter intended for measurement of ion clusters. The low altitude instrument was designed to measure negative or positive ions in the high pass or the band pass modes. Its range extended to 255 amu. Digital control of the bias and the quadrupole excitation signals was maintained during the flight through a program stored in an EPROM. A manual control unit which could be substituted for the EPROM provided flexibility during laboratory experimentation and calibration procedures.
Author (GRA)

N79-24588# Denver Univ., Colo. Dept. of Mathematics.
DIRECT METHODS FOR SEISMIC PROFILING Progress Report
N. Bleistein and Jack K. Cohen 20 Dec. 1978 27 p refs
(Contract EY-76-S-02-2482)
(COO-2482-9) Avail: NTIS HC A03/MF A01

Accomplishments in the following areas are described: (1) treatment of perturbations from non-constant reference speed in one dimensional propagation problems; (2) development and computer coding of a three dimensional inversion algorithm in the constant reference speed case; (3) increase of efficiency of the computer code for velocity inversion which makes the central processing requirements of the code comparable to processing now done in the seismic community; (4) examination of the validity and use of the Kirchhoff approximation in the inverse problem; (5) velocity inversion via our methods in the context of the parabolic approximation; and (6) applications of inversion techniques to non-destructive testing.
DOE

N79-24589# Cornell Univ., Ithaca, N. Y. Dept. of Geological Sciences.
RECENT VERTICAL CRUSTAL MOVEMENTS FROM LEVELING OBSERVATIONS IN THE RIO GRANDE RIFT: A REVIEW
R. E. Reilinger, L. D. Brown, J. E. Oliver, and J. E. York (LASL) 1978 27 p refs Presented at the Symp. on the Rio Grande Rift, Santa Fe, N. Mex., 8 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3195; Conf-781082-1) Avail: NTIS HC A03/MF A01

Analysis of repeated leveling surveys suggests significant contemporary vertical deformation in at least three distinct areas in the vicinity of the Rio Grande rift. These areas include Socorro, New Mexico; the Diablo Plateau region of Trans-Pecos Texas; and the Espanola basin in northern New Mexico. The Socorro area is characterized by uplift relative to its surroundings. Maximum relative uplift of about 20 cm between 1911 and 1951 occurred about 25 km north of Socorro, corresponding to an average relative velocity of 5mm/yr. The primary anomaly, defined by a north-south profile between El Paso, Texas, and Albuquerque, New Mexico, extends from 15 km south to 70 km north of Socorro. The Diablo Plateau region is also characterized by relative uplift. Uplift of approximately 13 cm during the period from 1934 to 1958 was observed along an approximately east-west profile from El Paso, Texas, to Carlsbad, New Mexico.
DOE

N79-24590# International Meteorological Inst., Stockholm (Sweden).
[ACTIVITIES OF THE INTERNATIONAL METEOROLOGICAL INSTITUTE] Annual Report, July 1977 - June 1978
Sep. 1978 28 p
(AR-77-78) Avail: NTIS HC A03/MF A01

Research activities in dynamic meteorology, atmospheric chemistry, atmospheric physics, and geophysical fluid mechanics are presented. Lists of publications and visiting scientists are given together with a financial statement.
Author (ESA)

N79-24591# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF AERIAL AND SURFACE OZONE MEASUREMENTS DURING THE SECOND HALF OF 1977 [ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHENOZONMESSUNGEN IM 2 HALBJAHR 1977]
1978 116 p In GERMAN
(Sonderbeob-36) Avail: NTIS HC A06/MF A01

Surface ozone measurement data are presented as a function of date, daily mean level, daily maximum level, time when maximum level was recorded, duration of extreme values in excess of 100n bar, daily minimum level, and monthly mean levels. Total ozone measurement data obtained using a Dolson spectrophotometer are given. Airborne data transmitted by radiosonde from medium and great heights are presented as a function of air pressure, air temperature, air density, dew point, relative humidty, etc.
Author (ESA)

N79-24592# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
RESULTS OF THE GEOSCIENTIFIC INVESTIGATIONS FROM THE VALDIVA CRUISE VA-10/1975 OFF WESTERN AFRICA
Juergen Fritsch, Karl Hinz, Ulrich vonRad, Hans-Albert Roeser, Gerd Wissman, and Wilfried Weigel Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1978 60 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared jointly with Hamburg Univ.
(BMFT-FB-M-78-03) Avail: NTIS HC A04/MF A01; Fachinformationzentrum Karlsruhe, West Ger. DM 12.40

Precise information, garnered from refraction gravitational measurements and geological samples, was obtained for two regions: Cape Verde Rise to Mauritania; Gran Canaria Island to Cape Bojador/Western Sahara. Sediments up to 10 km thick were proved to exist in a crustal section extending to the Mohorovicic discontinuity off Mauritania. Jurassic and Cretaceous sediments with seismic velocities typical for evaporitic and

carbonate facies form a lens several kilometers thick under the upper rise. Pronounced irregularities in seismic records suggest a high degree of episodic erosion of the continental margin. Oil conditions are shown to exist off Mauritania and Senegal (near a Cretaceous carbon platform) and off the Western Sahara (near an anticline of Cretaceous sediments). Author (ESA)

N79-24593# Office of Science and Technology, Washington, D. C.
EARTHQUAKE HAZARDS REDUCTION: ISSUES FOR AN IMPLEMENTATION PLAN
1978 248 p
(PB-290467/0) Avail: NTIS HC A11/MF A01 CSCL 08K

Attempt is made to identify and describe the problem areas or issues involved in implementing the Earthquake Hazards Reduction Act of 1977. The bulk of the paper aims at describing the interrelationships of the different issues and the uniqueness of each one. The issues discussed include: preparedness and response planning, earthquake prediction and warning, earthquake hazard reduction through construction programs, the role and relationships of financial institutions to financing hazard reduction etc. either public or private, land use planning and implementation, communications and education, and the roles of the public and private sectors in implementing the Act. In the appendix thirty-seven (37) issues are described and conclusions, along with recommendations and alternatives, are offered. GRA

N79-24594# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
EVALUATION AND PREDICTION OF AVALANCHE HAZARD, SAN JUAN MOUNTAINS, COLORADO Final Report, Nov. 1976 - Aug. 1978
Richard L. Armstrong and Betsy R. Armstrong Nov. 1978 139 p refs
(Contract DI-7-07-83-V0003)
(PB-290854/9; INSTAAR-7-07-83) Avail: NTIS HC A07/MF A01 CSCL 08L

A significant snow avalanche hazard exists along U.S. Highway 550 between Coal Bank Hill and the town of Ouray, Colorado. A statistical avalanche forecast model was developed based on discriminant analysis in order to predict avalanche activity. The data base, which contains meteorological, snowcover and avalanche variables, includes seven winter seasons. Specific data summaries for the 1976-1977 and 1977-1978 winters are included. Particular attention is given to accurate and detailed compilation of avalanche events within 214 avalanche paths. The prediction model is tested against actual avalanche activity observed during specific storms. S.E.S.

N79-24595# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
DIELECTRIC MEASUREMENTS OF FIVE DIFFERENT SOIL TEXTURAL TYPES AS FUNCTIONS OF FREQUENCY AND MOISTURE CONTENT Final Report
Ramon L. Jesch Oct. 1978 27 p refs Sponsored in part by Army Mobility Equipment Res. and Develop. Center, Fort Belvoir, Va.
(PB-291944/7; NBSIR-78-896) Avail: NTIS HC A03/MF A01 CSCL 08M

Open-circuit coaxial transmission-line sample holders were used to determine the electromagnetic dielectric properties of five soil textural types as functions of moisture level content and frequency. The theoretical basis is for the open-circuit method along with the measurement system and the sample preparation is presented. Experimental results are given for the different soil textural types for moisture levels ranging from 0 to 48 percent and for test frequencies ranging from 300 to 9300 MHz. GRA

N79-24596# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
SOME OBSERVATIONS ON THE RANDOM RESPONSE OF LINEAR AND NONLINEAR DYNAMICAL SYSTEMS M.S. Thesis
Alfred Barr Mason, Jr. Jan. 1979 129 p refs
(Grant NSF ENV-77-23687)
(PB-290808/5; EERL-79-01) Avail: NTIS HC A07/MF A01 CSCL 20K

Two problems are examined which are commonly encountered in the study of the response of randomly excited discrete dynamical systems. First, an extension of the method of equivalent linearization is used to obtain an approximate solution for the nonstationary response of a nonlinear system subjected to deterministically modulated stationary Gaussian random excitation. The accuracy of the approximate technique is investigated by means of Monte Carlo simulation. Secondly, an approximate method is developed for treating the first passage problem for the stationary response of a lightly damped linear oscillator excited by white noise. This method is extended to the nonstationary problem as well, and the accuracy of the approximate approach is examined. The analytical techniques developed are used to generate an earthquake-like random process which corresponds to a prescribed response spectrum. GRA

N79-24597# Environmental Protection Agency, Washington, D. C. Office of Toxic Substances.
A PRELIMINARY ANALYSIS NITROUS OXIDE (N2O) INCLUDING A MATERIALS BALANCE
C. Richard Cothern Jan. 1979 84 p refs
(PB-290853/5; EPA-560/6-79-001) Avail: NTIS HC A05/MF A01 CSCL 04A

The overall effect of N2O on stratospheric ozone is predicted to be small and could lead to an increase in stratospheric ozone. The contribution of man made nitrous oxide appears to be small at the present time but is expected to grow. The overall problem is an important one on the time scale 20-50 years and is not an immediate crisis. GRA

N79-24598# Radian Corp., Austin, Tex.
A STUDY OF OZONE CONCENTRATIONS IN SOUTHERN LOUISIANA Final Report
Joe D. Stuart, Michael A. Haecker, Hugh J. Williamson, David L. Harper, Bryan W. Lambeth, and W. Shelton Clark Sep. 1978 98 p refs
(PB-291823/3; RC-100-195; EPA-906/9-78-002A) Avail: NTIS HC A05/MF A01 CSCL 04A

The frequency of observations that were found exceeding the 80 ppb standard for ozone at the nine sites ranged from four to seventeen percent of available observation with ten percent of the total number of observations exceeding a concentration of 80 ppb. A total of five percent of the total ozone observations exceeded a concentration of 100 ppb. The diurnal oxidant pattern at each of the sites was similar to patterns typically found in urban areas. Upper air trajectories for periods of high ozone concentrations show that local urban sources are important contributors. Overall the NO2 and SO2 levels at all of the monitoring sites was very low. No concentrations of these pollutants in excess of air quality standard values were observed. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-24599 Kansas Univ., Lawrence.
TEMPORAL AND SPATIAL DISTRIBUTION OF HUMIDITY IN A SMALL CITY Ph.D. Thesis
James Albert Henry 1978 121 p
Avail: Univ. Microfilms Order No. 7910564

Dew-point temperatures over time and space in Lawrence, Kansas are described, explained, and related to the urban complex and selected meteorological variables. Forty-five urban-rural dew-point distributions were obtained during mornings, afternoons and evenings in August, September and October. Rural dew points exceeded urban values more frequently than the reverse. On a few dates a reversal of the urban-rural dew-point relationship occurred: in the afternoon rural dew points were greater than urban values, but at night urban values exceeded those in rural areas. Pattern complexity was generally at a maximum in the afternoon and was least complex during morning hours. Eigenvectors and associated coefficients were determined and correlated with land use, surface materials and meteorological parameters. Dissert. Abstr.

N79-24600 British Library Lending Div., Boston Spa (England).
THE ADVECTION OF SURFACE WATER TEMPERATURE BY WIND CURRENTS
A. N. Michurin 2 Jun. 1978 5 p refs Transl. into ENGLISH from Vest. Leningrad. Univ., Ser. Geol. (Leningrad), no. 2, 1977 p 150-153
(BLL-Trans-1369-(9022.549)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

An attempt is made to clarify the part played by wind-driven currents in the variability of the temperature conditions in the region of the Kuroshio region. It is shown that the changes in temperature during the period under review are small. The fluctuations in the computed values of temperature are small. The best agreement between actual and calculated temperature is at the near-boundary points (65,239) and is probably explained by the influence of the boundary values. G.Y.

N79-24601 British Library Lending Div., Boston Spa (England).
THE DISTRIBUTION OF MAXIMUM WIND SPEED
L. V. Aniskin and S. M. Persin Jul. 1978 5 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 377, 1977 p 119-124
(BLL-Trans-1368-(9022.549)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Information on the statistical properties of wind speed, in particular the distribution of the maximum speed over 10-minute or 2-minute intervals, as calculated by various methods, are compared. It is concluded, that even with inexact information about the statistical structure of the wind speed, a fairly good determination of the maximum speed over stated time intervals can be made by using the method of calculation A.R.H.

N79-24602 British Library Lending Div., Boston Spa (England).
OBTAINING WEATHER DATA BY RADAR IN SWITZERLAND
J. Joss 24 Jan. 1979 17 p refs Transl. into ENGLISH from Schweiz. Met. Zentralan., Arbeitsber (Switzerland), no. 79, 1978 20 p
(BLL-Trans-1389-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The principal characteristics of the data processing method chosen for meteorological radar used in Switzerland are (1) a space of 400 x 400 x 12 km is divided into blocks of 2 x 2 x 1 km; (2) the maximum value (and not the mean) of the elements is found; (3) limited information on height of precipitation is obtained by computing the elevation and side elevation; and (4) ground echoes are treated with a special algorithm. Specific aspects discussed include radar parameters, signal processing, suppression of ground echoes, data analysis, estimation of errors, and picture transmission and representation on the television screen or on the facsimile receiver. A.R.H.

N79-24603 British Library Lending Div., Boston Spa (England).
CHANGE OF THE TEMPERATURE TREND OVER THE NORTH ATLANTIC SINCE 1970
M. Teich 11 Oct. 1978 7 p refs Transl. into ENGLISH from Met. Rund. (West Germany), no. 31, 1978 p 92-94 In ENGLISH and GERMAN
(BLL-Trans-1392-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

It is shown that from about 1950 to 1970 there was a marked cooling trend in the water temperature of the North Atlantic, taken as an average of nine weather stations. It is also shown that during the research period of 1950-70 the steady variation in mean annual temperature was at times quite different over the European continent than it was over the North Atlantic. Accordingly, it is worthy of note that since about 1970 Central Europe is also seeing a warming trend. This is a consequence of especially frequent very warm winter months. Given a continuation of the now falling trend, colder than average winters are to be expected in the years ahead. It may be feared that a particular hard winter could occur very soon. G.Y.

N79-24604 British Library Lending Div., Boston Spa (England).
A SIMPLE METHOD FOR AN OBJECTIVE, LOCAL FORECAST OF GUSTS
H. Malberg, G. Frattesi, and W. Roeder 22 May 1978 11 p refs Transl. into ENGLISH from Met. Rund. (Berlin), v. 31, 1978 p 37-41
(BLL-Trans-1393-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A simple, statistical method is shown which can help the forecaster in an objective way with his job. Based on the daily observations of gusts between 10 a.m. and 4 p.m. and on calculations of the geostrophic windspeed at 1 p.m. the mean gust ratio q = V gust/V sub g is obtained depending on the geostrophic windspeed and the season, q is larger than 1 when the pressure gradient is small, and q is smaller than 1 when the pressure gradient is large. The verification of the method for one year showed quite good results. For windspeed V sub g less than or equal to 15 a mean absolute deviation was found between calculated and observed gusts of 1.0 kn, for V sub g between 16 and 30 kn of 2.3 kn and for V sub g greater than 30 kn of 3.5 kn. A slight improvement seems possible when taking into consideration the stability of the lower levels and the kind of air mass (maritime or continental) in the warm season. G.Y.

N79-24605 British Library Lending Div., Boston Spa (England).
A METHOD FOR FORECASTING FLIGHT VISIBILITY IN BAD WEATHER
B. Reichert 14 Nov. 1978 13 p refs Transl. into ENGLISH from Amt. Wehrgeoph., Fachl. Mitt. (West Germany), no. 187, 1978 p 157-162 In ENGLISH and GERMAN
(BLL-Trans-1394-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A diagnostic equation for quantitative forecasting of flight visibility was derived. Vertical variation of visibility and humidity in a single air mass without sizeable vertical exchange were contained in the equation. Values computed using the equation were compared with observations obtained from a helicopter. Then a simple method for calculating and forecasting the vertical change in visibility and the flight visibility was derived. It was found that the method could only be used in bad weather (low cloud, poor visibility, high relative humidity). R.E.S.

N79-24606 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 144. CONTRIBUTIONS TO THE PHENOLOGY OF EUROPE. PART 3: RESULTS FROM INTERNATIONAL PHENOLOGICAL GARDENS (REGIONAL AND ANNUAL DIFFERENCES) 1966-1975 [BERICHTAE DES DEUTSCHEN WETTERDIENSTES, BAND 18, NR. 144: BEITRAEGE ZUR PHAENOLOGIE EUROPAS III ERGEBNISSE AUS DEN INTERNATIONALEN PHAENOLOGISCHEN GAERTEN (REGIONALE UND JAHRESUNTERSCHIEDE) 1966-1975]
Fritz Schnelle 1977 34 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-157-5) Avail: Issuing Activity

Observations from 69 phenological gardens in Europe were evaluated. Mean data obtained during the period concerned, characterizing the development of vegetation in spring and the annual fluctuations in various regions, are presented. The onset of different phenological phases was investigated along several west-east and north-south cross sections across Europe together with the different spring developments. A phenological interception is given as an example: that of Populus canescens and tremula. Author (ESA)

N79-24607 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. NUMBER 145: THE TENSOR STRUCTURE OF CONSTITUTIVE EQUATIONS FOR LINEAR ATMOSPHERIC HEAT AND MOMENTUM EXCHANGE WITH AXISYMMETRIC COEFFICIENTS
Fritz Herbert 1978 42 p refs
(ISBN-3-88184-158-3) Avail: Issuing Activity

Axisymmetric expressions were derived for all tensor type exchange coefficients of interest for the description of small scale irreversible processes. The atmosphere (ocean) was considered as a one-component viscous fluid not subject to external forces. Angular momentum conservation criteria were considered and rotational phenomena arising from the exchange of mechanically

external and intrinsic angular momentum explained. The antisymmetric part of the stress tensor involved is discussed.
Author (ESA)

N79-24608# Witwatersrand Univ., Johannesburg (South Africa). Hydrological Research Unit.
A DEPTH-DURATION-FREQUENCY DIAGRAM FOR POINT RAINFALL IN SOUTHERN AFRICA
D. C. Midgley Aug. 1978 65 p refs
(Rept-2-78) Avail: NTIS HC A04/MF A01

A log-Gumbel distribution was fitted to data obtained from 8 autographic rainfall stations which show the maxima for durations of 15-, 30-, 60-, and 1440- minutes in each month of each year of record. Recognition of only one maximum for each year of record was used in abstracting values for revising the coaxial diagram used to estimate for a given return period, the maximum depth of precipitation likely to accumulate over a given duration anywhere in South Africa. To assertain the influence of mean annual precipitation (MAP) on extreme rainfall events, the Log-Gumbel means appropriate to each duration were plotted against the MAP. The new diagram shows a rise in mean with increase in MAP and shows clear distinction between coastal and inland stations for 15- and 60- minute events. This distinction is not discernible for the 1440- minute events because of the high incidence of thunderstorm activity in the interior, giving rise to high intensities for short durations. Tables for each of the 58 autographic rainfall stations in South Africa show results of the depth-duration-frequency analysis for 2, 5, 10, 50, and 100 year periods. A.R.H.

N79-24609# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
MODELLING THE WIND-FIELD IN THE PRETORIA REGION: MODEL DESCRIPTION AND VALIDATION
A. L. Smith Jun. 1978 55 p refs
(CSIR-APRG/78/1; ISBN-0-7988-1306-7) Avail: NTIS HC A04/MF A01

The approach to the development of a wind-field model centered around a model valid for stable atmospheric conditions is presented. Due to the pressing urgency for some suitable usable model, the initial emphasis was on numerical, rather than physical, aspects of modelling. The model developed for the Pretoria region is presented and the topics discussed are: (1) description of the model; (2) boundary conditions; (3) computational formulation; (4) performance of the model; (5) experimental validation; and (6) model results. The document also has a second part, an appendix detailing the model computer program and its operation. G.Y.

N79-24610# Council for Scientific and Industrial Research, Pretoria (South Africa). Air Pollution Research Group.
MODELLING THE WIND-FIELD IN THE PRETORIA REGION. APPENDIX: MODEL PROGRAM DESCRIPTION AND OPERATION
A. L. Smith and J. Hewitt Jun. 1978 83 p
(CSIR-APRG/78/2; ISBN-0-7988-1307-5) Avail: NTIS HC A05/MF A01

The computer program developed to run the model is described along with the practical details required to be known before running the program on the CSIR CDC CY 174 computer. To ensure maximum flexibility, the program was prepared in modular form. After a flow diagram of the basic computer program in which the relationship between the sub-programs and some of the sub-routines is illustrated, there is a description of each of the sub-programs. Each of the subroutines developed for the program is described. The method of executing the various subprograms is detailed. Data relating to the Pretoria regions are contained in existing data files which are also detailed. G.Y.

N79-24611# Science Applications, Inc., McLean, Va.
TROPICAL CYCLONE STRIKE PROBABILITY FORECASTING Final Report
Jerry D. Jarrell Dec. 1978 50 p refs
(Contract N00228-78-C-3127)
(AD-A065545; SAI-79-782-WA; NEPRF-CR-78-01) Avail: NTIS HC A04/MF A01 CSCL 04/2

A system to infer the probability of a tropical cyclone's striking within an area, given a tropical cyclone forecast, is described. The results of a sequence of tests are presented, which indicate that the system reasonably specifies the desired probability. Some envisioned operational applications of tropical cyclone strike probability information are described; some are illustrated.
Author (GRA)

N79-24612# Purdue Univ., Lafayette, Ind.
DISTURBED VERSUS UNDISTURBED CONDITIONS IN THE CARIBBEAN DURING THE INTENSIFICATION OF HURRICANE CARMEN (1974) M.S. Thesis
Richard Allen Todd, II May 1978 64 p refs
(Grant NSF ATM-75-10717)
(AD-A065517; AFIT-CI-79-116T) Avail: NTIS HC A04/MF A01 CSCL 04/2

A comparative diagnostic analysis of measured and computed properties for disturbed and undisturbed conditions in the Caribbean during Hurricane Carmen's (1974) intensification from a tropical depression just west of Guadeloupe (0000 GMT 30 August) to a major hurricane at landfall on the Yucatan Peninsula (1200 GMT 2 September) is presented. Disturbed and undisturbed regions are determined from SMS-1 infrared imagery. This satellite imagery, along with rawinsonde and surface reports taken during the Global Atmospheric Research Program's (GARP) Atlantic Tropical Experiment (GATE), represent the primary data used in this study. Means representing eight consecutive synoptic times, 12 hours apart, beginning at 0000 GMT are presented for measured and computed quantities. Comparisons are made between conditions in disturbed and undisturbed regions, and disturbed regions are partitioned into Carmen and other disturbances. A comparison is also made between Carmen's values calculated in this study and those given by Vincent and Waterman (1978) for a moving volume containing Carmen. GRA

N79-24613# Air Force Geophysics Lab., Hanscom AFB, Mass.
A FEASIBILITY STUDY OF THE USE OF RADIANT ENERGY FOR FOG DISPERSAL Final Scientific Report
Milton M. Klein 6 Oct. 1978 20 p refs
(AF Proj. 6670)
(AD-A063143; AFGL-TR-78-0240; AFGL-AFSG-398) Avail: NTIS HC A02/MF A01 CSCL 04/2

The source of microwave power was considered either ground-based or airborne. For the ground-based case, the microwave beam was taken as parallel to the ground and along the runway, providing a direct source of microwave power for heating the fog. For the airborne case, the beam was taken as perpendicular to the ground, the heating of the ground by the microwave beam providing a source of infrared power for dissipating the fog. The study showed that, for either case very large power densities, well above the personal safety limit of 100 W/sq m used in the U.S., would be required to dissipate the fog in a time of about 10 min. If the power density is taken as 100 W/sq m, a very long time, that is, many hours, would be required to dissipate the fog. In addition, because of the high cost of electrical energy the large amount of energy required to dissipate a typical airport fog (about 3 x 10 to the 11th power J) makes the scheme prohibitively expensive. GRA

N79-24614# Army Electronics Research and Development Command, Fort Monmouth, N. J. Combat Surveillance/Target ACQ Lab.
DOCUMENTATION OF SOFTWARE IN THE OL-192 METEOROLOGICAL DATA REDUCTION PROGRAM
Raymond Bellucci, Steven W. Burnett, and Thomas Richter Feb. 1979 187 p refs
(AD-A066218; DELCS-TR-79-1) Avail: NTIS HC A09/MF A01 CSCL 04/2

This report describes the software contained in the OL-192 Meteorological Data Reduction Program, and is intended to supply complete program description, file definitions, variable descriptions, flow charts, and program listing. The program was written for the Hewlett Packard 9825A Calculator. The OL-192 Meteorological Data Reduction Program quickly converts raw meteorological data into accurate real time meteorological messages. Real time meteorological data produced by the OL-192 increases the artillery commander's capability for a first round hit probability. This increases the effectiveness of friendly artillery, while reducing our weapons: exposure to enemy acquisition systems counter battery fires. The OL-192 is used by the artillery meteorological

sections to reduce the raw meteorological data received by the Radiosonde Recorder AN/TMQ-5(*) and the winds data received by the Control Recorder C-577(*), a component of the Radiosonde System AN/GMD-1(*). Input is entered from the calculator's console for real flight time computation. The OL-192 program can also calculate messages from the last flight data, punch pressure calibration tapes for radiosondes, and can print the flight information for each entered significant level and zone information for each zone height level. Author (GRA)

N79-24615# Bendix Corp., Kansas City, Mo.
MICROPROCESSORS AS A TOOL IN DETERMINING CORRELATION BETWEEN SFERICS AND TORNADO GENESIS
D. R. Witte Nov. 1978 33 p refs Presented at Mid-Am Electronics Conf. MAECON, Kansas City, Mo., 16 Nov. 1978
(Contract EY-76-C-04-0613)
(BDX-613-2122; Conf-781188-1) Avail: NTIS HC A03/MF A01

It is believed that sferics, a word that stands for atmospheric electromagnetic radiation, can be correlated to the genesis of tornadoes and severe weather. Sferics are generated by lighting and other atmospheric disturbances that are not yet entirely understood. The recording and analysis of the patterns in which sferic events occur, it is hoped, will lead to accurate real-time prediction of tornadoes and other severe weather. Collection of this data becomes cumbersome when correlation between at least two stations is necessary for triangulation; however, the advent of microprocessors made the task of data collection and massaging inexpensive and manageable. DOE

N79-24616# Brookhaven National Lab., Upton, N. Y.
EFFECTS OF CHANGES IN UPWIND SURFACE CHARACTERISTICS OF MEAN WIND SPEED AND TURBULENCE NEAR A COASTLINE
S. SethuRaman and G. S. Raynor 1979 4 p refs Presented at the 4th Symp. on Turbulence, Diffusion and Air Pollution, Reno, Nev., 15-18 Jan. 1979
(Contract EY-76-C-02-0016)
(BNL-25178; Conf-790101-2) Avail: NTIS HC A02/MF A01

Analysis of mean wind speed and longitudinal turbulence at a height of 8 m at an offshore buoy and the beach indicated that the mean winds at the buoy were always higher by 30 to 100 percent depending on the wind speed. A relationship seems to exist between the changes in turbulence and the direction of flow. Generally minimum values were observed for onshore and maximum for offshore flows. In order to increase the statistical significance of the results, analysis has to be done with a larger set of data. DOE

N79-24617# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY ZONAL MODEL ANALYSIS OF THE CLIMATIC CHANGE RESULTING FROM INCREASED ATMOSPHERIC CARBON DIOXIDE
Gerald L. Potter Nov. 1978 31 p refs Presented at US/USSR Symp. of the Effects of Carbon Dioxide on Climate, Dushanbe, USSR, 10 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81575; Conf-7810151-1) Avail: NTIS HC A03/MF A01

A two-dimensional zonal atmospheric model is used to test the possible atmospheric response to various carbon dioxide concentrations. The preliminary results are presented to provide a basis for future improvement of the model and better understanding of the feedback mechanisms that prevail given different atmospheric carbon dioxide concentrations. DOE

N79-24618# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
METHOD FOR USING ACOUSTIC SOUNDER CATEGORIES TO DETERMINE ATMOSPHERIC STABILITY
J. F. Schubert 1979 4 p refs Presented at the 4th Symp. on Turbulence, Diffusion and Air Pollution, Reno, Nev., 15-18 Jan. 1979
(Contract EY-76-C-09-0001)
(DP-MS-78-49; Conf-790101-10) Avail: NTIS HC A02/MF A01

The acoustic sounder continuously measured the rate of change in the height of the mixed layer which is an important parameter in calculating the transport and diffusion of radioactive and nonradioactive air pollutants. Continuous record convective cells, travity waves, inversions, and frontal systems permitted analysis of the synoptic and complex stabilities of the area. DOE

N79-24619# Stockholm Univ. (Sweden). Dept. of Meteorology.
A MIXED LAYER MODEL OF WIND AND DENSITY DRIVEN MIXING DURING A PHYTOPLANKTON BLOOM
Mohamed S. Smeda and Wayne Wilmot Oct. 1978 37 p refs Sponsored jointly by Swed. Environ. Protec. Board, Swed. Natl. Sci. Res. Council, and the Libyan Govt. Prepared jointly with Inten. Meteorol. Inst., Stockholm
(DM-24) Avail: NTIS HC A03/MF A01

A mixed layer model was formulated and tested against observed data from the Baltic Sea for a period of 50 days. The model is based on the energy conservation in which both temperature and salinity fluxes, along with the wind, are considered as the source of energy. The model has shown capability for predicting the development of the mixed layer for the observed conditions. Author (ESA)

N79-24620# Oxford Univ. (England). Engineering Lab.
AN ANALYTICAL APPROACH TO WIND VELOCITY GUST FACTORS
M. E. Greenway 1978 52 p refs
(OUEL-1241/78) Avail: NTIS HC A04/MF A01

An equation for deriving wind velocity gust factors appropriate to a given structure was developed based on the structure size to longitudinal integral turbulence length ratio rather than on a selected value of averaging time. Analyses reveal that the gust factors given by the equation are linearly dependent on turbulence intensity and increase with increasing observation time. Good agreement exists between the gust factors yielded by the equation and empirical values obtained from measurements made during a wind tunnel simulation of the atmospheric boundary layer. Author (ESA)

N79-24621# Hawaii Univ., Honolulu. Dept. of Civil Engineering.
WIND ENGINEERING RESEARCH DIGEST, VOLUME 3, 1978 Periodic Report, 1975 - 1978
Arthur N. L. Chiu Nov. 1978 174 p refs
(Grant NSF ENG-76-19806)
(PB-290694/9) Avail: NTIS HC A08/MF A01 CSCL 04B

Reports of ongoing resaerch activity in environmental aerodynamics throughout the United States are presented. Topic areas discussed include the following: structure of wind; wind-wave effects; effects on urban areas; wind loading on structures; severe storms; design for hurricanes and tornadoes; full-scale testing; model testing; environmental factors; psychophysical factors; legal factors; special problems; wing considerations in urban planning; building codes and regulations; socio-economic effects; international cooperation; and wing energy. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-24622# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
VARIATION OF THE OCEAN-ATMOSPHERE SYSTEM AS A CONSEQUENCE OF FEEDBACK MECHANISMS
Elmar R. Reiter 1978 15 p refs Presented at Conf. on Evolution of Planetary Atmospheres and Climatology of the Earth, Nice, 16-20 Oct. 1978
(Contract EY-76-S-02-1340; Grant NSF ATM-76-21017)
(COO-1340-58; Conf-7810134-1) Avail: NTIS HC A02/MF A01

The role of variable oceanic advective transport and of variable heat loss to the atmosphere is investigated. Changes in the water transport of the Kuroshio, possibly tied to trends in the u-component of the trade winds, may affect long-term

sea-surface temperature (SST) behavior off the coast of Japan. Short-term fluctuations of SST with large amplitudes appear to be in part caused by meandering characteristics of the ocean current, but perhaps even more so by local air-sea interaction. Zonal atmospheric wind stress variations strongly affect the meridional SST anomaly gradients in the Central North Pacific even more so than the SST anomalies. DOE

N79-24623# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany). Abt. Meerestechnik.
HIGH SPEED TV-TOWING SYSTEM FOR PROJECT DEFINITION STUDY FOR CONCEPTION AND DESIGN OF A DEEP SEA TOWING SYSTEM WITH TWO INSTRUMENTED EXPLORATION INSTRUMENTAL BODIES IN A TANDEM CONFIGURATION FOR CLOSE TO SEA FLOOR CONTROL Final Report
Peter Hartmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 55 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-77-05) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 11.55

A system capable of providing continuous observation of the the sea floor (up to a depth of 6,000 m) at a speed of between 6 and 8 knots was studied. The active controlled device GUSTAV (equipped with a TV system) can follow the contours of the sea floor. The passive controlled device SEP (about 100 m above the sea floor) plays a buoyance role. Studies were performed on the hydrodynamic drag of the towing cable and fairings. Special attention was given to the design and control of the system and to its performance under operating conditions. Author (ESA)

N79-24624# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
INVESTIGATIONS OF SEDIMENT CORES FROM THE CENTRAL PACIFIC SE OF HAWAII FROM THE VALDIVIA CRUISE 13/1 Final Report
Heinrich Meyer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-77-08) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 9.25

Sediment age, rate, and conditions were determined from paleomagnetic, radioactive, and paleontological evidence obtained from 11 piston cores. It was found that sedimentation has occurred throughout the area over the past 300,000 years; at particular stations continuous sedimentation has occurred for two mega years. Below this top sediment there is a hiatus with considerably older underlying material. The sedimentation rate varies with time and is dependent on the morphological properties of the area. These results and the regional distribution of resedimented material are presumed related to local bottom currents. Author (ESA)

N79-24625# Defence Research Information Centre, Orpington (England).
OBSERVATIONS ON THE PHYSICO-CHEMICAL FORMS OF COBALT, MANGANESE, ZINC, CHROMIUM AND IRON IN SEA WATER ENRICHED OR NOT WITH ORGANIC MATTER
Michel Marchand (CEA, Cherbourg, France) Aug. 1978 24 p refs Transl. into ENGLISH from Intern. Council for the Exploration of the Sea, Journal du Conseil, v. 35, no. 2, 1974 p 130-142 (DRIC-Trans-5370; BR65464) Avail: NTIS HC A02/MF A01

Using the radioisotropes of five metal elements (Co, Mn, Zn, Cr, Fe) as tracers, the various physico-chemical forms of the radioactive isotopes of the trace elements considered were determined by strong cationic resin chromatography in natural sea water, then in the same sea water enriched with marine algal organic matter. The experiment shows the effect of organic matter on the physico-chemical equilibrium of zinc, chromium), or cationic (zinc) organo-metallic complexes. The action of the organic matter is stronger as the degree of insolubility of the radionuclide increases. The occurence of iron and chromium organic complexes is less in sea water samples with weaker pH (4.5). Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-24626# Oak Ridge National Lab., Tenn.
EMERGENCE OF BIOTECHNOLOGY
Charles D. Scott 1978 26 p refs Presented at 16th Ann. New Horizons of Sci. Briefing, Gatlinburg, Tenn., 13 Nov. 1978 (Contract W-7405-eng-26)
(TID-28983) Avail: NTIS HC A03/MF A01

A brief review is given of recent new developments in biotechnology. The characteristics of bioprocesses discussed include specificity, isolation of the biological agent, and sophistication, and scale of bioprocesses. Examples of new areas of application of biotechnology are bioconversion of organic wastes to fuels or chemical feedstocks, resource recovery, and biophotolysis. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-24627 Case Western Reserve Univ., Cleveland, Ohio.
A DISCRETE PARAMETER MODEL OF THE HEAD AND NECK WITH NEUROMUSCULAR FEEDBACK Ph.D. Thesis
Guillermo Gutierrez 1978 253 p
Avail: Univ. Microfilms Order No. 7909433

A discrete, two dimensional model of the human head and neck is developed using Lagrangian and Hamiltonian dynamical principles. Particular attention is given to the role of the neuromusculature during the spine's response to acceleration directed along the mid-sagittal plane. The cervical spin and head are modelled by eight rigid masses connected by pin joints. The musculature of the neck is simulated by 16 unidirectional force elements. The components of this feedback system consist of a muscle spindle, represented by a transfer function in the form of a lead-lag filter, a gain constant for the spinal cord and pure time delays for the nerve transmission time. The system is implemented in a PDP 11/40 computer using FORTRAN language. The model parameters are obtained from cervical spine X-rays, isometric torque experiments and the published literature. A linear acceleration sled is used to validate the model. Dissert. Abstr.

N79-24628 Ohio State Univ., Columbus.
AN INVESTIGATION OF THE PULSE-SCATTER IMAGING TECHNIQUE FOR MEDICAL ULTRASONIC IMAGING AND TISSUE CHARACTERIZATION Ph.D. Thesis
Lawrence Dennis Nadel 1978 352 p
Avail: Univ. Microfilms Order No. 7908187

Pulse-Scatter Imaging, a new concept in ultrasonic imaging, was investigated for specific application to the field of medicine. The technique incorporates both scattered energy and pulse-echo signals into a cross-sectional view via linear algebraic image reconstruction in conjunction with a 320+320 pixel computerized tomography gray scale display. Dissert. Abstr.

N79-24629 West Virginia Univ., Morgantown.
STRESS AND FATIGUE IN THE DRIVING ENVIRONMENT Ph.D. Thesis
Michael Lester Romansky 1978 581 p
Avail: Univ. Microfilms Order No. 7910911

The relative effects of a moderate or suboptimal level of environment heat and noise stress on human fatigue arising from sources which may not be specifically related to the driving task were studied. Data were collected for task performance parameters, physiological variables, and subjective responses during stress and nonstress conditions. Physiological variables that were measured included heart rate, heart rate variability, galvanic skin response, electromyography, blood pressure, oral temperature, 17-ketosteroids, and 17-hydroxycorticosteroids. Evidence of a decrement in task performance, altered psychophysiological well-being, and discomfort and displeasure with the test environment was provided by subjects for the stress condition. The findings indicate that the stress condition was more fatiguing

to subjects than the nonstress condition. Generally, subjects experienced more displeasure, dissatisfaction, and mental and physical discomfort for the stress condition. Dissert. Abstr.

N79-24630*# National Aeronautics and Space Administration, Washington, D. C.
MEDICAL SCIENCE IN SIBERIA: OXYGEN EXCHANGE IN THE FAR NORTH
V. Kulikov and M. Yegunova Apr. 1979 6 p Transl into ENGLISH from Meditsinkaya Gazeta (USSR), 23 Aug. 1978 p 3 Transl by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75391) Avail: NTIS HC A02/MF A01 CSCL 06P

Differences in oxygen conditions between the native and migrant Siberian population were studied in relation to respiratory function, arterial and venous blood indicators and acid-base indicators. Significant adaptation differences were ascertained between the two populations. Author

N79-24631*# New York Univ., N. Y. Dept. of Physics.
ATMOSPHERIC NEUTRONS Final Report
Serge A. Korff, Rosalind B. Mendell, Milton Merker, Edward S. Light, Howard J. Verschell, and William S. Sandie May 1979 188 p refs
(Contract NAS1-10282)
(NASA-CR-3126) Avail: NTIS HC A09/MF A01 CSCL 06R

Contributions to fast neutron measurements in the atmosphere are outlined. The results of a calculation to determine the production, distribution and final disappearance of atmospheric neutrons over the entire spectrum are presented. An attempt is made to answer questions that relate to processes such as neutron escape from the atmosphere and C-14 production. In addition, since variations of secondary neutrons can be related to variations in the primary radiation, comment on the modulation of both radiation components is made. G.Y.

N79-24632*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATIONS ABOUT THE QUANTITATIVE CHANGES OF CARBON DIOXIDE PRODUCTION IN HUMANS. REPORT 2: CARBON DIOXIDE PRODUCTION DURING FEVER AND ITS RELATIONSHIP WITH HEAT PRODUCTION
C. Liebermeister Dec. 1978 54 p refs Transl. into ENGLISH from Deut. Arch. fuer Klin Med. (West Germany), v. 8, 1871 p 153-205 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75452) Avail: NTIS HC A04/MF A01 CSCL 06P

Investigations are cited and explained for carbon dioxide production during fever and its relationship with heat production. The general topics of discussion are: (1) carbon dioxide production for alternating fever attacks; (2) heat balance during the perspiration phase; (3) heat balance during the chill phase; (4) the theory of fever; and (5) chill phase for other fever attacks. G.Y.

N79-24633*# General Electric Co., Houston, Tex.
FLUID AND ELECTROLYTE BALANCE MODEL (FEB)
D. G. Fitzjerrell 24 Jan. 1973 16 p
(Contract NAS9-12932)
(NASA-CR-160206) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of various oral input water loads on solute and water distribution throughout the body are presented in the form of a model. The model was a three compartment model; the three compartments being plasma, interstitial fluid and cellular fluid. Sodium, potassium, chloride and urea were the only major solutes considered explicitly. The control of body water and electrolyte distribution was affected via drinking and hormone levels. R.E.S.

N79-24634*# General Electric Co., Houston, Tex. Space Div.
VALIDATION OF A MODEL FOR INVESTIGATING RED CELL
J. I. Leonard 10 May 1976 29 p refs Presented at the Operations Res. Soc. of Am. (ORSA) Natl. Meeting, Las Vegas, Nev. 17-19 Nov. 1975 Repr. from the ORSA Bull., Suppl. 2, v. 23, 1975 29 p
(Contracts NAS9-14523; NAS9-12932)
(NASA-CR-160188) Avail: NTIS HC A03/MF A01 CSCL 06S

The model, both the conceptual model and simulation model, provided a convenient framework on which to demonstrate the commonality between such diverse stresses as descent from altitude, red cell infusions, bed rest, and weightlessness. The results suggest that all of these stresses induce an increased blood hematocrit leading to tissue hyperoxia and eventual inhibition of the erythyocyte producing circuit until the hyperoxic condition is relieved. The erythropoietic system was acting, in these situations, as if it were an hematocrit sensor and regulator. In these terms the decreases in red cell mass during Skylab may be explained in terms of normal feedback reulation of the erythropoietic system in the face of sustained decreases in plasma colume. R.E.S.

N79-24635*# General Electric Co., Houston, Tex. Apollo Systems Dept.
USER'S INSTRUCTIONS FOR THE GRODINS' RESPIRATORY CONTROL MODEL USING THE UNIVAC 1110 REMOTE BATCH AND DEMAND PROCESSING
6 Sep. 1974 74 p
(Contract NAS9-12932)
(NASA-CR-160225; TIR-741-MED-4024) Avail: NTIS HC A04/MF A01 CSCL 06P

The transient and steady state response of the respiratory control system for variations in volumetric fractions of inspired gases and special system parameters are modeled. The program contains the capability to change workload. The program is based on Grodins' respiratory control model and can be envisioned as a feedback control system comprised of a plant (the controlled system) and the regulating component (controlling system). The controlled system is partitioned into 3 compartments corresponding to lungs, brain, and tissue with a fluid interconnecting patch representing the blood. J.M.S.

N79-24636*# General Electric Co., Houston, Tex.
A LONG TERM MODEL OF CIRCULATION Final Report, 1973-1974
Ronald J. White 15 Aug. 1974 59 p refs Prepared in cooperation with Mississippi Univ., Jackson
(Contract NAS9-12932)
(NASA-CR-147674; TIR-741-MED-4021) Avail: NTIS HC A04/MF A01 CSCL 06P

A quantitative approach to modeling human physiological function, with a view toward ultimate application to long duration space flight experiments, was undertaken. Data was obtained on the effect of weightlessness on certain aspects of human physiological function during 1-3 month periods. Modifications in the Guyton model are reviewed. Design considerations for bilateral interface models are discussed. Construction of a functioning whole body model was studied, as well as the testing of the model versus available data. J.A.M.

N79-24637*# General Electric Co., Houston, Tex. Apollo Systems Dept.
TRANSIENT THERMOREGULATORY MODEL WITH GRAPHICS OUTPUT
D. J. Grounds 17 Jul. 1974 25 p
(Contract NAS9-12932)
(NASA-CR-160217; TIR-741-MED-4011; DM-110T) Avail: NTIS HC A02/MF A01 CSCL 06P

A user's guide is presented for the transient version of the thermoregulatory model. The model is designed to simulate the transient response of the human thermoregulatory system to thermal inputs. The model consists of 41 compartments over which the terms of the heat balance are computed. The control mechanisms which are identified are sweating, vaso-constriction and vasodilation. J.M.S.

N79-24638*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE 41-NODE THERMOREGULATORY MODEL (STEADY STATE VERSION)
J. I. Leonard 25 Jul. 1974 33 p
(Contract NAS9-12932)
(NASA-CR-160220; TIR-741-MED-4015) Avail: NTIS HC A03/MF A01 CSCL 06P

A user's guide for the steady-state thermoregulatory model

is presented. The model was modified to provide conversational interaction on a remote terminal, greater flexibility for parameter estimation, increased efficiency of convergence, greater choice of output variable and more realistic equations for respiratory and skin diffusion water losses. J.M.S

N79-24639*# General Electric Co., Houston, Tex. Apollo Systems Dept.
EVALUATION OF EXERCISE-RESPIRATORY SYSTEM MODIFICATIONS AND PRELIMINARY RESPIRATORY-CIRCULATORY SYSTEM INTEGRATION SCHEME Interim Report
R. R. Gallagher (Kansas State Univ.) 16 Jul. 1974 25 p refs
(Contract NAS9-12932)
(NASA-CR-160221; TIR-741-MED-4016; MA-252T) Avail: NTIS HC A02/MF A01 CSCL 06P

The respiratory control system, functioning as an independent system, is presented with modifications of the exercise subroutine. These modifications illustrate an improved control of ventilation rates and arterial and compartmental gas tensions. A very elementary approach to describing the interactions of the respiratory and circulatory system is presented. Author

N79-24640*# General Electric Co., Houston, Tex. Apollo Systems Dept.
ACID-BASE HOMEOSTASIS IN THE HUMAN SYSTEM
Ronald J. White (University Medical Center, Jackson, Miss.) 16 Aug. 1974 25 p refs
(Contract NAS9-12932)
(NASA-CR-12932; TIR-741-MED-4017) Avail: NTIS HC A02/MF A01 CSCL 06P

Acid-base regulation is a cooperative phenomena in vivo with body fluids, extracellular and intracellular buffers, lungs, and kidneys all playing important roles. The present account is much too brief to be considered a review of present knowledge of these regulatory systems, and should be viewed, instead, as a guide to the elements necessary to construct a simple model of the mutual interactions of the acid-base regulatory systems of the body. Author

N79-24641*# General Electric Co., Houston, Tex.
DESIGN SPECIFICATION FOR THE WHOLE-BODY ALGORITHM
D. G. Fitzjerrell 9 Sep. 1974 13 p refs
(Contract NAS9-12932)
(NASA-CR-160226; TIR-741-MED-4025) Avail: NTIS HC A02/MF A01 CSCL 06P

The necessary requirements and guidelines for the construction of a computer program of the whole-body algorithm are presented. The minimum subsystem models required to effectively simulate the total body response to stresses of interest are (1) cardiovascular (exercise/LBNP/tilt); (2) respiratory (Grodin's model); (3) thermoregulatory (Stolwijk's model); and (4) long-term circulatory fluid and electrolyte (Guyton's model). The whole-body algorithm must be capable of simulating response to stresses from CO2 inhalation, hypoxia, thermal environmental exercise (sitting and supine), LBNP, and tilt (changing body angles in gravity). A.R.H.

N79-24642*# General Electric Co., Houston, Tex.
SYSTEMS IDENTIFICATION AND APPLICATION SYSTEMS DEVELOPMENT FOR MONITORING THE PHYSIOLOGICAL AND HEALTH STATUS OF CREWMEN IN SPACE Study Report
J. I. Leonard, S. Furukawa, and P. VanNordstrand 30 Jun. 1975 65 p refs
(Contract NAS9-12032)
(NASA-CR-160235; TIR-741-MED-5012) Avail: NTIS HC A04/MF A01 CSCL 06P

The use of automated, analytical techniques to aid medical support teams is suggested. Recommendations are presented for characterizing crew health in terms of: (1) wholebody function including physiological, psychological and performance factors; (2) a combination of critical performance indexes which consist of multiple factors of measurable parameters; (3) specific responses to low noise level stress tests; and (4) probabilities of future performance based on present and periodic examination of past performance. A concept is proposed for a computerized real time biomedical monitoring and health care system that would have the capability to integrate monitored data, detect off-nominal conditions based on current knowledge of space-flight responses, predict future health status, and assist in diagnosis and alternative therapies. Mathematical models could play an important role in this approach, especially when operating in a real time mode. Recommendations are presented to update the present health monitoring systems in terms of recent advances in computer technology and biomedical monitoring systems. J.M.S.

N79-24643*# General Electric Co., Houston, Tex.
PHYSIOLOGICAL SYSTEM INTEGRATIONS WITH EMPHASIS ON THE RESPIRATORY-CARDIOVASCULAR SYSTEM
R. R. Gallagher (Kansas State Univ.) 13 Jan. 1975 65 p refs
(Contract NAS9-12932)
(NASA-CR-160230) Avail: NTIS HC A04/MF A01 CSCL 06P

The integration of two types of physiological system simulations is presented. The long term model is a circulatory system model which simulates long term blood flow variations and compartmental fluid shifts. The short term models simulate transient phenomena of the respiratory, thermoregulatory, and pulsatile cardiovascular systems as they respond to stimuli such as LBNP, exercise, and environmental gaseous variations. An overview of the interfacing approach is described. Descriptions of the variable interface for long term to short term and between the three short term models are given. M.M.M.

N79-24644*# General Electric Co., Houston, Tex.
STUDY REPORT ON COMBINING DIAGNOSTIC AND THERAPEUTIC CONSIDERATIONS WITH SUBSYSTEM AND WHOLE-BODY SIMULATION
S. Furukawa 1 Jul. 1975 43 p refs
(Contract NAS9-12932)
(NASA-CR-160231; TIR-741-MED-5006) Avail: NTIS HC A03/MF A01 CSCL 06P

Current applications of simulation models for clinical research described included tilt model simulation of orthostatic intolerance with hemorrhage, and modeling long term circulatory circulation. Current capabilities include: (1) simulation of analogous pathological states and effects of abnormal environmental stressors by the manipulation of system variables and changing inputs in various sequences; (2) simulation of time courses of responses of controlled variables by the altered inputs and their relationships; (3) simulation of physiological responses of treatment such as isotonic saline transfusion; (4) simulation of the effectiveness of a treatment as well as the effects of complication superimposed on an existing pathological state; and (5) comparison of the effectiveness of various treatments/countermeasures for a given pathological state. The feasibility of applying simulation models to diagnostic and therapeutic research problems is assessed. A.R.H.

N79-24645*# General Electric Co., Houston, Tex.
THE APPLICATION OF SENSITIVITY ANALYSIS TO MODELS OF LARGE SCALE PHYSIOLOGICAL SYSTEMS
Joel I. Leonard Oct. 1974 67 p refs
(Contract NAS9-12932)
(NASA-CR-160228) Avail: NTIS HC A04/MF A01 CSCL 06P

A survey of the literature of sensitivity analysis as it applies to biological systems is reported as well as a brief development of sensitivity theory. A simple population model and a more complex thermoregulatory model illustrate the investigatory techniques and interpretation of parameter sensitivity analysis. The role of sensitivity analysis in validating and verifying models, and in identifying relative parameter influence in estimating errors in model behavior due to uncertainty in input data is presented. This analysis is valuable to the simulationist and the experimentalist in allocating resources for data collection. A method for reducing highly complex, nonlinear models to simple linear algebraic models that could be useful for making rapid, first order calculations of system behavior is presented. M.M.M.

N79-24646*# National Aeronautics and Space Administration. Pasadena Office, Calif.

APPARATUS AND METHOD OF INSERTING A MICROELECTRODE IN BODY TISSUE OR THE LIKE USING VIBRATION MEANS Patent Application
Cyril Feldstein (JPL), Donald W. Crawford (JPL), and Evangelyn W. Kanabus, inventors (to NASA) (JPL) Filed 6 Sep. 1976 18 p Sponsored by NASA
(NASA-Case-NPO-13910-1; US-Patent-Appl-SN-712270) Avail: NTIS HC A02/MF A01 CSCL 06B

An arrangement for and method of inserting a glass microelectrode, having a tip in the micron range, into body tissue is disclosed. The top of the microelectrode is attached to the diaphragm center of a first speaker. The microelectrode tip is brought into contact with the tissue by controlling a micromanipulator. Thereafter, an audio signal is applied to the speaker to cause the microelectrode to vibrate and thereby pierce the tissue surface without breaking the microelectrode tip. Thereafter, the tip is inserted into the tissue to the desired depth by operating the micromanipulator with the microelectrode in a vibratory or nonvibratory state. Means including a second speaker are disclosed. NASA

N79-24647# Texas Univ. at Galveston. Comparative Marine Neurobiology Div.
THE EFFECTS OF HIGH NITROGEN TENSIONS OF THE PROPERTIES OF NEURONAL MEMBRANES AND SYNAPTIC TRANSMISSION Final Report, Mar. 1973 - May 1977
James E. Blankenship, Robert Feinstein, and Howard J. Bryant Jan. 1979 41 p refs
(Contract N00014-75-C-0547)
(AD-A063856) Avail: NTIS HC A03/MF A01 CSCL 07/2

The effects of increased air, nitrogen and/or hydrostatic pressures to 10 ATA have been studied on electrophysiological properties of identified neurons in two model neurobiological preparations, the marine mollusc Aplysia and the crayfish. Studies were done in vitro in a pressurization chamber with intracellular recordings using multiple microelectrodes in identified neurons in the Aplysia ganglion or from the crayfish giant axon. Ten ATA of air had no demonstrable effect on the resting potential, membrane resistance, time constant or action potential of neurons R2, R14 and R15 Aplysia, and equivalent pressures of nitrogen or hydrostatic force did not affect resting potential of crayfish axon. The rates of depolarization and repolarization of the crayfish axon action potential were increased significantly by nitrogen tensions to 8.6 ATA: depolarization rate, 2.2 + or - 0.2%/atm; repolarization rate, 2.1 + or - 0.2%/atm. Action potential duration was decreased (0.91 + or - 0.19%/atm) under these conditions. Hydrostatic pressure alone had an opposite effect on polarization rates. GRA

N79-24648# Wayne State Univ., Detroit, Mich. Dept. of Electrical and Computer Engineering.
STUDIES ON THE MICROWAVE-INDUCED AUDITORY EFFECT Final Report, 1 Sep. 1975 - 28 Feb. 1978
James C. Lin Feb. 1978 80 p refs
(Grant NSF ENG-75-15227)
(PB-290598/2; BES-1) Avail: NTIS HC A05/MF A01 CSCL 06P

The mechanism of microwave-induced auditory effect in humans and animals who are exposed to short rectangular pulses of microwave energy is studied. Assuming that the effect arises from sound waves generated in the tissues of the head by rapid thermal expansion caused by microwave absorption, the governing thermoelastic motion equation is solved for a spherical model of the head. Results indicate that the frequency of the auditory signal is a function of the size and acoustic property of tissues in the head. Using microwave-induced auditory brainstem responses, it found that the experimentally observed characteristics agree well with theoretical prediction in regard to pulse width and frequency of impinging microwaves, pattern of absorbed microwave energy, frequency of vibration, and threshold of sensation. GRA

N79-24649# Tracor Jitco, Inc., Rockville, Md.
CHEMICALS IDENTIFIED IN HUMAN BIOLOGICAL MEDIA, A PILOT LITERATURE SURVEY
Randall D. Huffman and Cynthia Aller Jan. 1979 82 p refs
(Contract EPA-68-01-4116)
(PB-290690/7; EPA-560/6-79-002) Avail: NTIS HC A05/MF A01 CSCL 06T

For the past three years, the Office of Toxic Substances Monitoring Division involved investigating the establishment of a data base of chemicals identified in human tissues and body fluids. A preliminary computer search in 1976 revealed that adequate descriptors do not exist for retrieving body-burden information from existing computer files and indicated a manual approach would be necessary. The results of a pilot manual literature survey accomplished for the period January 1977 through September 1978 are reported. Fifty-one relevant articles containing information on fifty-three different substances were identified in forty-two selected journals. Data extracted from those articles is organized alphabetically by substance. GRA

N79-24650# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: BIOLOGICAL EFFECTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1979
Elizabeth A. Harrison Mar. 1979 89 p Supersedes NTIS/PS-78/0120, NTIS/PS-77/0171, NTIS/PS-76/0177 and NTIS/PS-75/320
(NTIS/PS-79/0190/3; NTIS/PS-78/0120; NTIS/PS-77/0171; NTIS/PS-76/0177; NTIS/PS-75/320) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

The selected abstracts cover the effects of sonic booms on humans, animals, birds, and fish. Discussions of biophysics, psychoacoustics, stress, and auditory tolerances are presented, along with materials on startle responses, disturbance, and compression wave reactions. (This updated bibliography contains 81 abstracts, 4 of which are new entries to the previous edition.) GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-24651* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACESUIT MOBILITY KNEE JOINTS Patent
Hubert C. Vykukal, inventor (to NASA) Issued 1 May 1979 19 p Filed 3 Mar. 1978 Supersedes N78-18763 (16 - 09, p 1209) Division of US Patent Appl. SN-753965, filed 23 Dec. 1976, US Patent-4,091,464
(NASA-Case-ARC-11058-2; US-Patent-4,151,612; US-Patent-Appl-SN-883094; US-Patent-Class-2-2.1A; US-Patent-Class-285-235; US-Patent-4,091,464; US-Patent-Appl-SN-753965) Avail: US Patent and Trademark Office CSCL 05H

Pressure suit mobility joints are for use in interconnecting adjacent segments of an hermetically sealed spacesuit in which low torques, low leakage and a high degree of reliability are required. Each of the joints is a special purpose joint characterized by substantially constant volume and low torque characteristics and includes linkages which restrain the joint from longitudinal distension and includes a flexible, substantially impermeable diaphragm of tubular configuration spanning the distance between pivotally supported annuli. The diaphragms of selected joints include rolling convolutions for balancing the joints, while various joints include wedge-shaped sections which enhance the range

of motion for the joints.
Official Gazette of the U.S. Patent and Trademark Office

N79-24652* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMPACT ARTIFICIAL HAND Patent
Gordon A. Wiker (JPL) and Wolfgang A. Mann, inventors (to NASA) (JPL) Issued 17 Apr. 1979 7 p Filed 27 Sep. 1977 Supersedes N77-32723 Sponsored by NASA
(NASA-Case-NPO-13906-1; US-Patent-4,149,278; US-Patent-Appl-SN-837259; US-Patent-Class-3-12.5; US-Patent-Class-3-1.1; US-Patent-Class-414-6) Avail: US Patent and Trademark Office CSCL 06B

A relatively simple, compact artificial hand, is described which includes hooks pivotally mounted on first frame to move together and apart. The first frame is rotatably mounted on a second frame to enable 'turning at the wrist' movement without limitation. The second frame is pivotally mounted on a third frame to permit 'flexing at the wrist' movement. A hook-driving motor is fixed to the second frame but has a shaft that drives a speed reducer on the first frame which, in turn, drives the hooks. A second motor mounted on the second frame, turns a gear on the first frame to rotate the first frame and the hooks thereon. A third motor mounted on the third frame, turns a gear on a second frame to pivot it.
Official Gazette of the U.S. Patent and Trademark Office

N79-24653 Houston Univ., Tex.
OPERATOR PERFORMANCE AND LOCALIZED MUSCLE FATIGUE IN A SIMULATED SPACE VEHICLE CONTROL Ph.D. Thesis
James Leon Lewis, Jr. 1978 86 p
Avail: Univ. Microfilms Order No. 7910232

Fourier transforms in a special purpose computer were utilized to obtain power spectral density functions from electromyograms of the biceps brachii, triceps brachii, brachioradialis, flexor carpi ulnaris, brachialis, and pronator teres in eight subjects performing isometric tracking tasks in two directions utilizing a prototype spacecraft rotational hand controller. Analysis of these spectra in general purpose computers established general agreement with previous studies, aided in defining muscles involved in performing the task, and yielded a derived measure potentially useful in predicting task termination. This technique of relatively non-obtrusive monitoring and analysis has potential practical utility in work station and tool design, physical training, medical applications, and extravehicular pressure-suited work activities for large scale space construction missions. Additional applied research must be conducted to identify derived measures sensitive to the needs of the designer and practically useful in design and real-time applications. Dissert. Abstr.

N79-24654*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT TEST EVALUATION OF AN RAF HIGH ALTITUDE PARTIAL PRESSURE PROTECTIVE ASSEMBLY
George R. Ashworth (System Development Corp., Edwards, Calif.), Terrill W. Putnam, William J. Dana, Einar K. Enevoldson, and William R. Winter Jun. 1979 37 p ref
(NASA-TM-72864) Avail: NTIS HC A03/MF A01 CSCL 06K

A partial pressure suit was evaluated during tests in an F-104 and F-15 as a protective garment for emergency descents. The garment is an pressure jerkin and modified anti-g suit combined with an oronasal mask. The garment can be donned and doffed at the aircraft to minimize thermal buildup. The oronasal mask was favored by the pilots due to its immobility on the face during high g-loading. The garment was chosen to provide optimum dexterity for the pilot, which is not available in a full pressure suit, while protecting the pilot at altitudes up to 18,288 meters, during a cabin decompression, and subsequent aircraft descent. During cabin decompressions in the F-104 and F-15, cabin pressure altitude was measured at various aircraft angles of attack, Mach numbers, and altitudes to determine the effect of the aerodynamic slipstream on the cabin altitude. R.E.S.

N79-24655# Aeronautical Research Labs., Melbourne (Australia).
IMPACT TESTS ON CRASH HELMETS FOR MOTOR CYCLISTS
N. D. Hearn and S. R. Sarrailhe Apr. 1978 36 p refs
(AD-A065966; ARL-Struc-Note-445) Avail: NTIS HC A03/MF A01 CSCL 14/2

Seven types of crash helmets were subjected to a series of impact tests as detailed in the current Australian Standard. Impact accelerations were usually less than 75% of the maximum permitted values, but second impacts near the front edge usually resulted in excessive accelerations. Four types of helmets, two with fiberglass shells and two with polycarbonate shells, were exposed to the weather for 15 to 17 months and one of the polycarbonate shells suffered degradation in its resistance to penetration. Author (GRA)

N79-24656# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
US NAVY DEVELOPMENT OF AN ON-BOARD OXYGEN GENERATION (OBOG) SYSTEM
Matthew J. Lamb 6 Dec. 1978 20 p refs
(AD-A063958; NADC-78257-60) Avail: NTIS HC A02/MF A01 CSCL 06/11

The Naval Air Development Center has been conducting a development program to explore the On-Board Oxygen Generation (OBOG) concept for application aboard tactical naval aircraft. The objective of the program is to eliminate hazardous and logistically burdensome LOX (liquid oxygen) installations on ships, as well as forward basing areas, by generation of oxygen on board the aircraft. The purpose of this paper is to report on progress to date in the program which includes: (1) Major reduction in values of weight and resource requirements to acceptable levels, (2) Development of hardware prototypes of the proposed systems suitable for flight test, (3) Aircraft/OBOG systems integration studies, (4) Laboratory T and E of the prototype systems, (5) Physiological assessment (man rating) of the prototype systems, and (6) Flight testing to date. GRA

N79-24657# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A TWO LEVEL MODEL OF HUMAN STEERING BEHAVIOR IN A MOTOR VEHICLE [EIN ZWEI-EBENEN-MODELL DES MENSCHLICHEN LENKVERHALTENS IM KRAFTFAHRZEUG]
E. Donges Mar. 1977 178 p refs In GERMAN; ENGLISH summary
(FB-27) Avail: NTIS HC A09/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

In establishing design criteria for vehicle dynamics which may improve the performance of the driver-vehicle system, a quantitative description of driver steering behavior was formulated. The steering task was divided into two levels. The guidance level, involving the perception of the instantaneous and future course of the forcing function provided by the forward view of the road and the response to it in an anticipatory open-loop control mode, and the stabilization level, whereby any occurring deviations from the forcing function are compensated for in a closed-loop control mode. This concept of the quality of the driver's steering activity led to a two-level mathematical model of driver steering behavior. Its parameters were identified on the basis of data measured in driving simulator experiments. The parameter estimates of both levels of the model show significant dependence on the experimental situation which can be characterized by variables such as vehicle speed and desired path curvature. Author (ESA)

N79-24658*# National Bureau of Standards, Washington, D. C. Center for Mechanical Engineering and Process Technology.
PROXIMITY-VISION SYSTEM FOR PROTOFLIGHT MANIPULATOR ARM Final Report
James S. Albus Jan. 1979 22 p
(NASA Order H-30093-B)
(NASA-CR-158652; PB-291335/8; NBSIR-78-1576) Avail: NTIS HC A02/MF A01 CSCL 13H

The NBS Proximity-Vision System consist of two separate but complementary subsystems: (1) a solid-state TV camera with 128 x 128 resolution elements mounted on the manipulator wrist; and (2) a pair of close-range infrared proximity sensors mounted in the fingertips. The system is built for a manually controlled teleoperator. The design is also suitable for

computer image analysis in the control of an autonomous robot manipulator. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N79-24659 Arizona State Univ., Tempe.
SPECTRAL CHARACTERISTICS OF PIECEWISE POLYNOMIAL REPRESENTATION OF DIGITAL SIGNALS Ph.D. Thesis
George Edward Iddings 1978 182 p
Avail: Univ. Microfilms Order No. 791126

Each of the (n-1) sections of an nth order polynomial representation of a digital signal is shown to have a unique, low pass filtering characteristic. Knowledge of these characteristics made it possible to predict and control a composite spectral response for data processing routines using polynomial representation of the digital signal. Piecewise polynomial transforms (PPT) of digital signals with equal weighting of selected sections of the polynomials were used to demonstrate the case of spectral analysis. The response of selected examples are shown and the results of spectral analysis are demonstrated. Error and noise sources were identified and quantized along with methods for circumventing or minimizing them. Data compression capabilities of the polynomial were evaluated and found to be wanting. Resolution capabilities of PPT were found to be equivalent to and as flexible as closed form transforms. Dissert. Abstr.

N79-24660 Oklahoma Univ., Norman.
ERROR ANALYSIS OF DIGITAL FILTERS WITH LOGARITHMIC NUMBER SYSTEM Ph.D. Thesis
Tomio Kurokawa 1978 174 p
Avail: Univ. Microfilms Order No. 7911157

The capability and limitations in implementing filters with microcomputers, using these logorithmic number systems were determined. Addition error in logarithmic number system is shown theoretically and experimentally to be the sum multiplied by a random variable which has an approximately uniform probability distribution. Formula is derived for logarithmic filter's accumulated roundoff errors for the case of stochastic input. It is shown theoretically that a logarithmic filter's accumulated roundoff error is smaller than that of a floating point filter, given the same number of bits and equal range for both of the number systems. Several filters are tested for the comparison between the logarithmic and the floating point filter errors (coefficient quantization, input quantization, and accumulated roundoff errors together). A design procedure is given for digital filters. The logarithmic number system is specified which satisfies the requirements of the error to signal ratio, the memory utilization, the speed and the range specifications. Dissert. Abstr.

N79-24661 Case Western Reserve Univ., Cleveland, Ohio.
CHARACTERISTICS AND APPLICATIONS OF DISTRIBUTED ASSOCIATIVE MEMORY ALGORITHMS Ph.D. Thesis
William Louis Schultz 1979 121 p
Avail: Univ. Microfilms Order No. 7909370

The associative memory algorithm is based on Walsh functions that produces estimates of correlation coefficients between incident or unknown patterns that were previously stored via the algorithm. The algorithm saved memory space by causing several patterns to be stored in the same memory space required by a single unprocessed pattern. Processing time was reduced by means of the fast discrete Walsh transform used to produce the correlation coefficient estimates from the overlayed memory pattern. The error in the estimates attributed to the storage process was investigated both theoretically and experimentally. The number of patterns that could be overlayed without loss of the ability to be associatively identified increased with memory size. The technique was applied to the estimation of pattern attributes in the contexts of medical diagnosis, signal processing, and vehicle tracking and identification. Dissert. Abstr.

N79-24662 Princeton Univ., N. J.
DATA COMPRESSION: METHODS AND COMPLEXITY ISSUES Ph.D. Thesis
James Andrew Storer 1979 209 p
Avail: Univ. Microfilms Order No. 7910128

Data compression methods using abstract computational complexity as well as a practical macro model are presented. Trade-offs between different varieties of macro schemes, exact lower bounds on the amount of compression obtainable, and the complexity of encoding and decoding are discussed. Dissert. Abstr.

N79-24663 Texas Univ. at Austin.
PARALLEL ALGORITHMS FOR MULTIPLE PROCESSOR ARCHITECTURES Ph.D. Thesis
Victor Paul Holmes 1978 218 p
Avail: Univ. Microfilms Order No. 7910975

An algorithm oriented approach is taken in solving problems in a computing environment utilizing multiple processors. An examination of two problem areas is made in the context of their inherent parallelism and parallel algorithms are designed to take advantage of this concurrent. The correctness of these algorithms is demonstrated as well as a measure of complexity and performance. Distributed algorithms are specified for discrete event simulation of queueing with first come first served queueing discipline using a computing network of microcomputers. Queueing network topologies simulated include tandem and feed-forward networks. These simulation algorithms differ radically from conventional algorithms in that the concept of a global clock is nonexistent. An implementation was achieved on a dual processor NOVA 3 system and the details are given. Dissert. Abstr.

N79-24664 Michigan State Univ., East Lansing.
COMPUTATIONAL DESIGN ALTERNATIVES WITH MICROPROCESSOR-BASED SYSTEMS Ph.D. Thesis
Sigurd Leland Lillevik 1978 134 p
Avail: Univ. Microfilms Order No. 7907363

For a microprocessor-based system, the computational section reduces to combinations of four elemental computational design alternatives (CDA's). The described research examines and characterizes these CDA's and develops a structured approach to computational section design which incorporates a rigorous, theoretic foundation. Dissert. Abstr.

N79-24665# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
COMPUTER RESOURCE PERFORMANCE MANAGEMENT A TOTAL DATA CENTRE APPROACH
E. N. vanDeventer and J. D. Roode Nov. 1978 45 p refs
(CSIR-TWISK-54) Avail: NTIS HC A03/MF A01

A Computer Resource Performance Management (CRPM) system is based on a total data center approach and uses a management information data base to support four different but

integrated management functions. The performance measurement management and tuning, performance data analysis, and resource performance management functions are discussed. The performance prediction and modelling function is described, which is based upon an operational analysis multiclass queuing network model results indicate that such an integrated CRPM system is an indispensable tool in the objective approach to computer installation management. S.E.S.

N79-24666# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
MULTIMODE CPU DESIGN STUDY Final Report, May 1977 - May 1978
Gary L. Mallaley, Alfred Ess, and Alexander Mihich Jun. 1978 172 p refs
(Contract F33615-77-C-1158; AF Proj. 6096)
(AD-A066241; AFAL-TR-78-134) Avail: NTIS HC A08/MF A01 CSCL 09/2

A study was conducted to define a Multimode CPU architecture in which the CPU could handle instruction addressing, data addressing, and data processing. A problem set of signal processing tasks was defined from which the architectural design evolved. The multiplier/FFT interaction was identified as a major architectural constraint. A RALU structure was defined to perform the data addressing and data processing. A microsequence structure was designed to perform the instruction addressing. Two complex-data signal processors were defined and designed at the register level. These processors, along with the Raytheon Micro Signal Processor and the Tracor/RCA General Processing Unit were addressed on their ability to perform benchmarks from the initial problem set. Author (GRA)

N79-24667# General Electric Co., Schenectady, N. Y.
ADVANCED ARCHIVAL MEMORY Interim Technical Report, 1 Jun. - 31 Dec. 1977
C. G. Kirkpatrick, H. G. Parks, G. E. Possin, R. C. Raymond, and K. G. Vosburgh Jul. 1978 424 p refs
(Contract F33615-76-C-1322; ARPA Order 3194)
(AD-A066298; SRD-78-041; AFAL-TR-78-96) Avail: NTIS HC A18/MF A01 CSCL 09/2

During this six-month period, work on the Advanced Archival Memory System has been concentrated on an ion-implantation based storage concept. Beam and target systems have been developed in parallel. Also, alternative data storage approaches have continued to be explored, and overall systems applications have been studied to provide guidance regarding the important technical parameters. The high current ion writing station appears feasible, and detailed design and construction were begun. However, the ion implant target bit packing density appears to be limited to 0.25 microns under best conditions, and to about 0.40 microns with presently available ion sources. The system applications study indicated that, if the technical goals of the program are met, this system should have superior price/performance features to all identified competitors. Author (GRA)

N79-24668# Emmanuel Coll., Boston, Mass.
INVESTIGATION OF MICROPULSATION ACTIVITY Final Report, 15 Oct. 1975 - 30 Sep. 1978
William F. Bellew, M. Patricia Hagan, and Robert L. Vesprini Hanscom AFB, Mass. AFGL Nov. 1978 127 p ref
(Contract F19628-76-C-0013; AF Proj. 7601)
(AD-A066344; AFGL-TR-78-0312) Avail: NTIS HC A07/MF A01 CSCL 09/2

Programs, functions, and subroutines were designed to collect, archive, and provide user access to date received from the MAGAF data collection network. Subroutines were written to unpack a data frame from received data order to instrument order, and also to repack data into received order. A series of plotting routines were added to the system to enable plot files in Varian Dataplot format and to produce magnetograms from the magnetometer network. Mathematical analyses have been performed on the data, including analysis of magnetic pulsations and of micropulsation events. Author (GRA)

N79-23902*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE APPLICATION OF MICROPROCESSOR TECHNOLOGY TO IN-FLIGHT COMPUTATION
Patricia L. Sawyer and Dan M. Somers *In its* The Sci. and Technol. of Low Speed and Motorless Flight, Pt. 1 1979 p 267-284 refs (For primary document see N79-23889 15-01)
Avail: NTIS HC A13/MF A01 CSCL 09B

N79-24942# Joint Publications Research Service, Arlington, Va.
MICROPROCESSORS AND LSI MICROPROCESSOR SETS AS THE COMPONENT BASE OF MODERN DIGITAL SYSTEMS
M. K. Bushuyev, A. A. Galitsyn, and I. I. Shagurin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 1-17 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radioelektron. (Kiev), vol. 21, no. 12, 1978 p 18-28 (For primary document see N79-24941 15-99)
Copyright. Avail: NTIS HC A04/MF A01

N79-24943# Joint Publications Research Service, Arlington, Va.
BIPOLAR DYNAMIC MEMORY CELLS
A. S. Berezin, V. A. Lapshinskiy, and Ye. M. Onishchenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 3 Apr. 1979 p 18-30 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radioelektron. (Kiev), vol. 21, no. 12, 1978 p 29-36 (For primary document see N79-24941 15-99)
Copyright. Avail: NTIS HC A04/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-24669 Texas Univ. at Austin.
A SYSTEM FOR INCREMENTALLY DESIGNING AND VERIFYING PROGRAMS Ph.D. Thesis
Mark Steven Moriconi 1977 257 p
Avail: Univ. Microfilms Order No. 7911056

A computer system for incrementally designing and verifying large, complex programs is described. It executes commands, proposes actions, answers questions, and accepts and reasons about new or changed information. The system responds to changes by applying a new methodology, that is useful in other areas in which incremental reaction to change is important. Parts of a general framework for designing incremental systems are proposed. The system for incremental development was used to completely design and verify several programs, including a simple message switching network that allows secure, asynchronous message transfer among a fixed number of users. Dissert. Abstr.

N79-24670 Connecticut Univ., Storrs.
AN INTERACTIVE CLASSICAL CONTROL DESIGN ALGORITHM FOR MULTIVARIABLE SYSTEMS IN STATE-SPACE FORM Ph.D. Thesis
Gordon Kui Fong Lee 1978 152 p
Avail: Univ. Microfilms Order No. 7911384

A simple design algorithm which blends the mathematical elegance of state-space theory with the graphical simplicity of root locus techniques is presented. An algorithm was developed for the constant output feedback problem which incorporates Jordan blocks to expose the influence of the gain matrix on the poles of the system. The methodology is extended to PI control and general filter design. Plant and compensator dynamics are described in such a way that the influence of compensation on the poles of the system is directly observed. Zero placement is discussed and a general control design package is developed which implements the methodology. Examples are provided to illustrate the simplicity of the algorithm. Dissert. Abstr.

N79-24671*# Illinois Univ., Urbana. Radio Research Lab.
OPERATING MANUAL FOR THE RRL 8 CHANNEL DATA LOGGER
E. J. Paluch, J. D. Shelton, and C. S. Gardner May 1979 124 p refs

(Grant NsG-5049)
(NASA-CR-158633; RRL-Publ-502) Avail: NTIS HC A06/MF A01 CSCL 09B

A data collection device which takes measurements from external sensors at user specified time intervals is described. Three sensor ports are dedicated to temperature, air pressure, and dew point. Five general purpose sensor ports are provided. The user specifies when the measurements are recorded as well as when the information is read or stored in a minicomputer or a paper tape. M.M.M.

N79-24672*# Lockheed Electronics Co., Houston, Tex.
PROGRAM DOCUMENTATION. PROGRAM DESCRIPTION AND USER INFORMATION FOR THE HYDRAULICS/ AUXILIARY POWER UNIT (HYDRA) COMPUTER PROGRAM
W. J. Redwine Mar. 1979 176 p refs
(Contract NAS9-15800)
(NASA-CR-160178; LEC-13265; JSC-14805) Avail: NTIS HC A09/MF A01 CSCL 09B

A timeline containing altitude, control surface deflection rates and angles, hinge moment loads, thrust vector control gimbal rates, and main throttle settings is used to derive the model. The timeline is constructed from the output of one or more trajectory simulation programs. S.E.S.

N79-24673# General Electric Co., Daytona Beach, Fla.
COMPUTER IMAGE GENERATION: IMPROVED EDGE UTILIZATION STUDY Final Report, Jan. 1977 - May 1978
E. Marvin Bunker and Roland F. Pester Feb. 1979 75 p
(Contract F33615-77-C-0033; AF Proj. 6114)
(AD-A065640; AFHRL-TR-78-81) Avail: NTIS HC A04/MF A01 CSCL 05/9

Computer Image Generation (CIG) systems for visual scene simulation are now being procured for research and as pilot training simulators. Any given system has limited edge capacity, so it is important that the edges be utilized effectively to provide the simulated visual scene for training. The level-of-detail concept in current CIG systems improves efficiency of edge utilization. A feature at such a distance that it has a small view window image is computed at a low level of detail using few edges. As the viewer approaches the feature, and its image becomes larger, a model containing more detail and more edges is computed to represent it. The high sensitivity of the eye to abrupt changes makes the transition distracting and limits the usefulness of this technique. This study developed techniques to produce a gradual transition from one detail to the other. Evaluation scenes and sequences demonstrated this to be far less obvious and distracting. Another area of investigation provided high detail in the portion of the view window to which the view is directed (the 'area of interest') with gradual transition to low detail elsewhere.
Author (GRA)

N79-24674# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
OPTIMALITY OF SPLINE ALGORITHMS Interim Report
G. W. Wasilkowski and H. Wozniakowski Dec. 1978 39 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22555)
(AD-A065637; CMU-CS-79-104) Avail: NTIS HC A03/MF A01 CSCL 12/1

Algorithms were studied for approximating Sf where S is a linear operator and f is an element of a set. The concept of spline algorithms is introduced and optimality properties of these algorithms are established. This unifies and generalizes many known results. GRA

N79-24675# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERLISP-11 Final Technical Report, 1 Jul. 1977 - 31 Jun. 1978
Alice K. Hartley Mar. 1979 43 p refs
(Contract N00014-77-C-0480)
(AD-A066142; BBN-4076) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the implementation of an Interlisp system on a PDP-11/40 with writable control store and an extended virtual address space. The system provides on a minicomputer the capability and performance previously available only on large time sharing systems. Author (GRA)

N79-24676# Boeing Computer Service Co., Inc., McLean, Va.
LHC-PILOT, USER GUIDE
Glen I. Chapman and William H. Ford, Jr. May 1978 78 p Prepared in cooperation with Lister Hill Natl. Center for Biomed. Commun., Bethesda, Md.
(Contract N01-LM-6-4755)
(PB-291985/0; LHNCBC-78-05; NLM/LHC-TR-7801) Avail: NTIS HC A04/MF A01 CSCL 09B

A computer based education programming language LHC-PILOT designed for easy control of interactive conversations between a computer system and a user terminal is described. The feasibility of providing a single and multi-user PILOT system capable of running on a wide variety of minicomputer hardware configurations was examined. Version 1.1 of the LHC-PILOT User Guide describes the language as it is implemented on Data General Minicomputers. GRA

N79-24677# Boeing Computer Service Co., Inc., McLean, Va.
LHC-PILOT, SYSTEM GUIDE
Glen I. Chapman and William H. Ford, Jr. May 1978 43 p Prepared in cooperation with Lister Hill National Center for Biomedical Communications, Bethesda, Md.
(Contract N01-LM-6-4755)
(PB-291986/8; LHNCBC-78-06; NLN/LHC-TR-7802) Avail: NTIS HC A03/MF A01 CSCL 09B

LHC-PILOT is a computer based education programming language designed for easy control of interactive conversations between a computer system and a user terminal. Installation, system generation, the logging facility, device specification, user authorization file, and terminal handlers are described. GRA

N79-24678# Bureau of Labor Statistics, Washington, D. C.
LINEAR LEAST SQUARES REGRESSION ALGORITHM: NMGS2
James W. Longley and John B. Dash 1978 59 p
(PB-290475/3; BLS/DF-79/022A) Avail: NTIS HC A04/MF A01 CSCL 09B

A linear regression program is presented in FORTRAN 4 and implemented on the IBM 360/370 computers. It uses a LOGICAL string of bytes to shut off overflow and underflow. Since length of vector is not necessary in the intermediate stages of the calculations, vectors are reduced to unit length to increase numerical stability of algorithm and to facilitate calculations of side statistics in the process of solution. There is an option for weighted least squares, and also an option for singular value decomposition. The program has variable dimension statements which introduces considerable flexibility in economy of core.
GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-24679 Texas Univ. at Austin.
ALGORITHMIC AND COMPUTER CODE DEVELOPMENTS FOR COMBINATORIAL AND NETWORK PROBLEMS Ph.D. Thesis
Richard Stuart Barr 1978 158 p
Avail: Univ. Microfilms Order No. 7910929

Two different approaches to linear distribution network flow problems and a new algorithm for solving fixed charge transportation problems were investigated. A new out-of-kilter algorithm is presented with computational testing that indicates that this methodology is the most efficient of its kind available. A new primal extreme point algorithm for solving transportation problems is also given which not only circumvents and exploits degeneracy, but restricts consideration to a special subset of the bases that can lead to an optimal solution. Also described is a new implicit enumeration algorithm for the fixed charge transportation problem. A mixed integer programming code based on this technique was tested and shown to be the fastest in existence for this important class of problems. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-24680 Ohio Univ., Athens.
DESIGN OF SIGNAL SYNTHESIS MODEL REFERENCE ADAPTIVE CONTROL SYSTEMS FOR LINEAR AND NONLINEAR UNKNOWN PLANTS Ph.D. Thesis
Kassem Ahmed Riad 1978 162 p
Avail: Univ. Microfilms Order No. 7909462

A design procedure is presented for a controller, using signal synthesis model following adaptive control techniques, for unknown, single-input, single-output or multiple-input, multiple output, constant or time varying, linear or nonlinear plants using lower order model. The nonlinear plants treated are those which have nonlinearity in the feedback. The problem of disturbance and noise was investigated and a solution was developed to implement the design procedure. Simulation of several examples covering linear, nonlinear, single-input, single-output and multiple-input, multiple-output systems are included. The design proposed for the multiple-input, multiple-output system is applied to the control of coupled core nuclear reactor. It is shown that each core power can be independently controlled. Dissert. Abstr.

N79-24681# Washington Univ., Seattle. Dept. of Electrical Engineering.
DIGITAL SYSTEM THEORY Annual Report
James S. Meditch Feb. 1979 9 p
(Grant AF-AFOSR-3546-78; AF Proj. 2304)
(AD-A065764; AFOSR-79-0113TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research progress on the development of new methods for the design of digital control systems through the use of inverse systems and their signal recovery properties is described. New results in the problem areas of vector-delay inverses and pseudoinverses are reviewed, and a novel inverse system/state observer structure for optimal control of dynamic systems is presented. The research results are applicable to both deterministic and stochastic linear systems described in either the time or frequency domain. A major component of the research is dedicated to the development of efficient algorithms for the software implementation of vector-delay inverses and pseudoinverses. These algorithms provide tests for the existence of such inverses and then proceed to the task of realization. Theoretical studies show that the concept of vector-delay inverses includes all previous research on classical L-delay inverses as special cases. Further, the results on pseudoinverses provide means for recovering all possible unknown system inputs and/or disturbances when neither the classical nor vector-delay inverses exist.
Author (GRA)

N79-24682# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ESTIMATION OF AIRCRAFT TARGET MOTION USING PATTERN RECOGNITION ORIENTATION MEASUREMENTS Ph.D. Thesis
Jerry D. Kendrick Dec. 1978 208 p refs
(AD-A066195; AFIT/DS/EE/78-6) Avail: NTIS HC A10/MF A01 CSCL 17/8

A new approach to estimating motion of a highly maneuvering aircraft target in an air-to-air tracking scenario is presented. An interactive filter system is developed which provides an improved estimate of target motion states by conditioning kinematic filter estimates upon target aspect angle data. Pattern recognition techniques used with an electro-optical tracker are presumed to provide this target aspect information. A target orientation filter processes the aspect angle measurements by statistically weighting measured aspect angles with the current best estimate of target kinematics. The aerodynamic lift equation is used to relate approximate angle of attack to target velocity and acceleration. A novel statistical model for aircraft target normal acceleration is also developed to better represent unknown target accelerations. Simulation results of realistic three-dimensional scenarios are presented to evaluate the performance of the interactive filter system. The report contains a 56-item bibliography. Author (GRA)

N79-24683# Oxford Univ. (England). Engineering Lab.
SIMULATION STUDY OF SELF-TUNING CONTROL LAWS
R. S. Atkinson 1977 74 p refs
(OUEL-1201/77) Avail: NTIS HC A04/MF A01

Problems associated with the application of self-tuning control in chemical engineering were studied with particular consideration given to non-minimum-phase systems using minimum-variance control strategies for industrial applications. A comparison is made between the performance of self-tuning controllers and conventionally tuned three-term Proportional-Integral-Derivative (PID) controllers. The emphasis throughout is on problems associated with the variation of sample time in the self-tuning control of processes with significant time-delays. Results are graphically illustrated. Author (ESA)

N79-24948# Joint Publications Research Service, Arlington, Va.
RESEARCH SHOWS WAYS TO FACILITATE INTRODUCTION OF ASU'S
I. Zhezhko and A. Krivtsov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 13-18 Transl. into ENGLISH from Materialno-Tekhn. Snabzheniye (Moscow), no. 11, 1978 p 87-89 (For primary document see N79-24946 15-99)
Copyright. Avail: NTIS HC A03/MF A01

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-24684 Rutgers - The State Univ., New Brunswick, N. J.
BIFURCATION OF PERIODIC SOLUTIONS IN FUNCTIONAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Max Ashkenazi 1978 94 p
Avail: Univ. Microfilms Order No. 7910363

The problem is given an abstract formulation as a nonlinear equation in a Banach space. The Lyapunov Schmidt method is used to derive a finite dimensional bifurcation equation to which methods of topological degree are applied. For quasilinear nonautonomous f.d.e., the periodic solutions that bifurcate from the periodic solutions of the corresponding linear system is analyzed. When the nonlinear part is high order, the existence of periodic solutions that bifurcate from the 0 solutions is considered. A general bifurcation theorem enables dealing with the autonomous case. Several examples are given to illustrate the applicability of the above results. Dissert. Abstr.

N79-24685 Rutgers - The State Univ., New Brunswick, N. J.
EXISTENCE AND UNIQUENESS OF POSITIVE SOLUTIONS OF A NONLINEAR INTEGRAL SOLUTIONS OF A NONLINEAR INTEGRAL SOLUTION Ph.D. Thesis
Nancy H. Baxter 1978 150 p
Avail: Univ. Microfilms Order No. 7910366

The existence and behavior of weak solutions are reported. By solving the equation for a Lebesque integrable solution it is equivalent to finding a function which defines a given autocorrelation function, a type of problem which arises, for example, in light scattering experiments. A finite system of equations which approximates the original integral equation and uses Newton's iteration method to investigate the existence of solutions and their shape are considered to estimate the critical value of lambda greater than 0 beyond which the nonlinear integral equation has no positive solutions, and to determine the behavior of the solution set for lambda near this critical value. Dissert. Abstr.

N79-24686 Florida State Univ., Tallahassee.
F-NORMED IDEALS OF SPACES OF MEASURABLE FUNCTIONS Ph.D. Thesis
David Elton Betounes 1978 127 p
Avail: Univ. Microfilms Order No. 7909748

A generalization of several results from Orlicz space theory to a class of function spaces which are called E sub A spaces

is presented. An E sub A space is a space determined by an F normed ideal E and a family A of maps between two vector lattices. Conditions for the completeness of certain E sub A function spaces are determined, and, with certain restrictions, families A and A sub 1 for which E sub A = E sub A sub 1 are characterized. A general theorem on the representation of the dual space for a wide class of function spaces is proven and is used to describe the duals of L sub F spaces defined by a family F of concave maps. The Lorentz spaces are described.
Dissert. Abstr.

N79-24687 Tennessee Univ., Knoxville.
ANALYZING THE SOLUTION OF PROBLEMS INVOLVING THREE-DIMENSIONAL GEOMETRIC FIGURES: AN EXPLORATORY STUDY Ph.D. Thesis
John Archibald Blake 1978 170 p
Avail: Univ. Microfilms Order No. 7911663

The difference in performance and methods between field independent and field dependent subjects; male and female subjects; and successful and unsuccessful subjects, as they solved mathematical problems involving three dimensional geometric figures are presented. Sixteen college freshmen were selected for participation. It was concluded that the drawings of the field independent subjects were neater, more accurate, and more relevant than those of field dependent subjects; the drawings of males were neater, more accurate, and more relevant than those of females. The average time spent by field independent subjects was higher than the average time spent by field dependent subjects. Field independent subjects analyzed the problems prior to attempting a solution. Male and female subjects who were successful problem solvers used this technique equally often.
Dissert. Abstr.

N79-24688 Princeton Univ., N. J.
REPRESENTING SIMPLE POLYTOPES BY ORDER STRUCTURES Ph.D. Thesis
Bruce A. Hedman 1979 134 p
Avail: Univ. Microfilms Order No. 7910111

The results about polytopes obtained are the following: (1) all simple polytopes in 3 dimensions are representable by primitive sets. (2) all d - simplices and (d + 2) - faceted simple polytopes in d dimensions are representable; (3) any simple polytope in 3 dimensions is combinatorially isomorphic to a subpolytope of a stack polytope; and (4) the diameter of any k - faceted d - dimensional representable polytope is less or equal to 2 (k-d).
Dissert. Abstr.

N79-24689 Rutgers - The State Univ., New Brunswick, N. J.
INTERVAL COUNTS AND THRESHOLD NUMBERS OF GRAPHS Ph.D. Thesis
Rochelle Liebowitz 1978 146 p
Avail: Univ. Microfilms Order No. 7910407

An interval graph is a graph G with a function J from the vertex set of G to the set of closed intervals on the real line such that two vertices are adjacent if and only if their corresponding intervals overlap. The lengths of the intervals in the interval assignments of G were investigated. The interval count of an interval graph G was the minimum number of different sized intervals needed for an interval assignment of G. Graphs with interval count 1 were called unit interval graphs. Four classes of graphs that have interval count 1 or 2 are shown. The generalization of 1-threshold graphs to k-threshold graphs is presented. A graph G was k-threshold if G is the union of k 1-threshold graphs. The smallest such k was called the threshold number of G. A subgraph of G which gives upper and lower bounds on the threshold number of G is discussed.
Dissert. Abstr.

N79-24690 Clemson Univ., S.C.
THE HANKEL AUTOCORRELATION Ph.D. Thesis
David Hilary Lubbers 1978 77 p
Avail: Univ. Microfilms Order No. 7909404

The Hankel autocorrelation was defined and bounded. These properties were established by a sequence of lemmas on the operations of Hankel transform theory. Interpretations of the Hankel autocorrelation and the Hankel spectrum are given. The Hankel autocorrelation is described geometrically as a radial average of a spherically symmetric function on several dimensional Euclidean space, thereby demonstrating the difference between the standard autocorrelation and the Hankel autocorrelation. The Hankel spectrum is given an interpretation analogous to the spectrum of the classical theory. The Hankel spectrum of a function is shown as the limit of the average of the modulus squared of the Hankel spectrum of the truncated function.
Dissert. Abstr.

N79-24691 Louisiana State Univ. and A&M Coll., Baton Rouge.
CONSTRUCTION OF INTEGRAL QUADRATIC FORMS Ph.D. Thesis
Paul Keith Wayland 1978 102 p
Avail: Univ. Microfilms Order No. 7911591

A generalization of the construction algorithm to integral n-ary forms is presented. The notion of semi-reduced form is introduced and techniques for detecting equivalent semi-reduced forms are examined. A table of quadratic forms in five variables is included. An extensive reduction theory for quaternary forms is developed. Although uniqueness is not obtained, the minimum of a reduced form and its representations are characterized. To increase the readability of later work, simultaneous representation is translated into systems of linear equations. A table of reduced quaternary forms is included. The procedures outlined provide a practical method of investigating questions concerning forms of a specific nature and are implemented by the use of a computer.
Dissert. Abstr.

N79-24692 Cornell Univ., Ithaca, N. Y.
FINITE ELEMENT GRID OPTIMIZATION WITH INTERACTIVE COMPUTER GRAPHICS Ph.D. Thesis
Mark Scott Shephard 1979 188 p
Avail: Univ. Microfilms Order No. 7910779

The major procedures of the optimal grid synthesis is described as follows: (1) Define the problem geometry by the specification of simply connected subregions, the boundaries of which are curves interactively established by the user; (2) Apply the loads, boundary conditions, and material properties interactively; (3) Generate an initial finite element mesh automatically and perform an initial analysis; (4) Place keynodes along the boundary curves using either an interactive or automatic procedure; (5) Generate a near-optimum finite element mesh using a set of mesh generators which produce meshes dependent on the placement of keynodes along the subregion boundaries; and (6) Perform a final analysis with the resulting mesh.
Dissert. Abstr.

N79-24693 Oregon Univ., Eugene.
SOME UNIQUENESS PROBLEMS IN NONLINEAR L SUB p-APPROXIMATION Ph.D. Thesis
Mohammad Reza Ahadi Akhlaghi 1978 77 p
Avail: Univ. Microfilms Order No. 7907438

The analysis of the uniqueness (or nonuniqueness) and characteristic properties of nonlinear best L sub p approximation problems is discussed. The first problem considers the possibility of providing a function which has at least three best approximations (not only with three local best approximations). The study shows a simple way to produce functions with more than any specified number of best approximations. L sub p approximation for $1 < p < 2$ is also considered. Results obtained for the cases $p = 1$ and $p > \text{or} = 2$ are extended to the case of $1 < p < 2$. An algorithm is presented for computing linear best L sub p approximation, $1 < p < 2$, when the underlying domain is a finite set.
Dissert. Abstr.

N79-24694*# National Aeronautics and Space Administration, Washington, D. C.
ON ISOCHRONOUS DERIVATIVES OF THE FIRST AND SECOND ORDER IN SPACE DYNAMICS TASKS
B. Ts. Bakshiyan and A. A. Sukhanov May 1979 26 p refs Transl. into ENGLISH from Russian report PR-357, 1977 p 1-27 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences USSR, Moscow (Contract NASw-3198)
(NASA-TM-75617) Avail: NTIS HC A02/MF A01 CSCL 12A

The first and second isochronous derivatives are calculated from the vector of state of dynamic system using its initial value. Use is made of the method of finding a fundamental

solution of conjugate variational equations. This solution and the corresponding universal relationship for isochronous derivatives are found for the two-body problem in a form which is simple and suitable for computer programming. The form of these relationships was obtained for motion which differs from parabolic motion. Formulas are given for isochronous derivatives using the gravitational parameter in the two-body problem. Author

N79-24695*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ROBUST STABILITY OF LINEAR SYSTEMS: SOME COMPUTATIONAL CONSIDERATIONS
Alan J. Laub May 1979 33 p refs Presented at the 2nd Ann. Workshop on the Inform. Linkage Between Appl. Math. and Industry, Monterey, Calif., 20-24 Feb. 1979
(Grant NGL-22-009-124; Contract ET-78-01-3395)
(NASA-CR-158620; LID-R-904) Avail: NTIS HC A03/MF A01 CSCL 12A

The cases of both additive and multiplicative perturbations were discussed and a number of relationships between the two cases were given. A number of computational aspects of the theory were also discussed, including a proposed new method for evaluating general transfer or frequency response matrices. The new method is numerically stable and efficient, requiring only operations to update for new values of the frequency parameter. R.E.S.

N79-24696*# National Aeronautics and Space Administration, Washington, D. C.
A CONTEMPORARY APPROACH TO THE PROBLEM OF DETERMINING PHYSICAL PARAMETERS ACCORDING TO THE RESULTS OF MEASUREMENTS
P. Ye. Elyasberg May 1979 53 p refs Transl. into ENGLISH of "Sovremennyy Podkhod k Zadache Opredeleniya Fizicheskikh Parametrov po Rezultatam Izmereniy", Rept. PR-429 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-55 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75616; PR-429) Avail: NTIS HC A04/MF A01 CSCL 12A

The shortcomings of the classical approach are set forth, and the newer methods resulting from these shortcomings are explained. The problem was approached with the assumption that the probabilities of error were known, as well as without knowledge of the distribution of the probabilities of error. The advantages of the newer approach are discussed. R.E.S.

N79-24697*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LEARNING WITH IMPERFECTLY LABELED PATTERNS
C. B. Chittineni Apr. 1979 33 p refs
(Contract NAS9-15800)
(NASA-CR-160183; LEC-13068; JSC-14867) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of learning in pattern recognition using imperfectly labeled patterns is considered. The performance of the Bayes and nearest neighbor classifiers with imperfect labels is discussed using a probabilistic model for the mislabeling of the training patterns. Schemes for training the classifier using both parametric and non parametric techniques are presented. Methods for the correction of imperfect labels were developed. To gain an understanding of the learning process, expressions are derived for success probability as a function of training time for a one dimensional increment error correction classifier with imperfect labels. Feature selection with imperfectly labeled patterns is described. S.E.S.

N79-24698# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN IMPULSE CONTROL POLICY FOR A CLASS OF JUMP DIFFUSION PROCESSES
Yaakov Yavin Nov. 1978 25 p refs
(CSIR-T-WISK-55) Avail: NTIS HC A02/MF A01

A system is given, dx = f(x)dt+ sigma (+) dw+ integral to the R to the nth power h(xu)q(dt,du), t greater than o, x element of R to the nth power, where W is a vector of independent standard Wiener processes and q is the zero mean Poisson random measure on (0, infinity) x R to the nth power. Given epsilon greater than 0, it is denoted by Tau 1, Tau 2,..., the instant of time at which the absolute value of x sub t -x sub t is greater than epsilon, where (x sub t,t is greater than or equal to 0) is the state of the system. An impulse control law is applied at the sequence of times Tau 1, Tau 2,... . Sufficient conditions are derived for a weak stability of the sample functions of the system, and sufficient conditions on optimal controls are given. An optimal control problem related to a linear system is solved. G.Y.

N79-24699# Rochester Univ., N. Y. Dept. of Statistics.
A GAUSSIAN APPROXIMATION TO THE DISTRIBUTION OF SAMPLE VARIANCE FOR NONNORMAL POPULATIONS Interim Report
Govind S. Mudholkar and Madhusudan C. Trivedi 1979 16 p refs
(Grant AF-AFOSR-3360-77)
(AD-A065738; AFOSR-79-0251TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A Gaussian approximation to the distribution of sample variance using Wilson-Hilferty approach is developed. It is studied for accuracy and compared with the well known approximations due to Box and Roy and Tiku by taking the exponential, the double exponential, the uniform, and the product normal distributions as the parent populations. The Wilson-Hilferty approximation which can be used for probabilities as well as percentiles is seen to compare favorably with the other two approximations. Author (GRA)

N79-24700# California Univ., Irvine.
THE OPTIMAL TRACKING PROBLEM FOR NONSTATIONARY STOCHASTIC PROCESSES
V. H. Syed (Fluor Corp., Irvine, Calif.) 1978 11 p refs Presented at the 7th Triennial World Congr. of the Intern. Federation of Automatic Control, Helsinki, 12-16 Jun. 1978
(Grants AF-AFOSR-2116-71; NSF ENG-73-03729-A02)
(AD-A062689; AFOSR-78-1472TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of optimal tracking of signals modeled as nonstationary stochastic processes was studied. The plant which tracks these signals can have time-varying parameters. A physically realizable (causal) compensator was designed, such that the mean-square tracking error was minimized, while the mean-square value of control was kept within specified bounds. The design of the optimal compensator was carried out entirely in the time-domain. Impulse response and a state-space realizations of the compensator were derived, and stability properties of the closed-loop system were studied. GRA

N79-24701# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
ASYMPTOTIC STABILITY OF A CLASS OF NONLINEAR SINGULARLY PERTURBED SYSTEMS Interim Report
Joe Hong Chow May 1978 8 p refs Repr. from J. Franklin Inst., v. 305, no. 5, May 1978 p 275-281
(Contract E(49-18)-2099; Grant AF-AFOSR-2570-73)
(AD-A062957; AFOSR-78-1566TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Sufficient conditions are obtained to guarantee the asymptotic stability of a class of non-linear singularly perturbed systems. A procedure for constructing a Lyapunov function for such a class of systems is given, and a clearly defined domain of attraction of the equilibrium is obtained. A stabilizing feedback control for such systems is also proposed. GRA

N79-24702# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstructionen.
ON THE NATURAL FACTOR IN NONLINEAR ANALYSIS
J. H. Argyris, T. L. Johnsen, and H. P. Mlejnek Aug. 1977 175 p refs
(ISD-242) Avail: NTIS HC A08/MF A01

The natural factor approach, as formulated for the linear displacement method, was extended to nonlinear analysis in order to avoid complex arithmetic. It is shown that the sparse population of the matrix factor may be efficiently utilized in the decomposition technique. Some numerical examples were analyzed such as the two-bar snap-through problem and the four-bar table. Results show that for ill-conditioned equations the method

performs numerically better than the standard Cholesky approach and, under certain circumstances, is the only way of obtaining acceptable results. Author (ESA)

N79-24703# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
CATASTROPHE THEORY IN HILBERT SPACE
Leif Arkeryd 1977 35 p refs
(Contract FOA-010-1431)
(CTH-Math-1977-17) Avail: NTIS HC A03/MF A01

The Gromoll Meyer reduction lemma is used to extend catastrophe theory to a Hilbert space context. The lemma reduces the infinite dimensional case to the known finite dimensional one. Mather's theorem about K determinate germs and the classification hold for Hilbert space. If one restricts to germs of codimension not exceeding 4 or 5, then there are respectively 7 or 11 equivalence classes. Author (ESA)

N79-24704# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
L SUB P-INTENSITIES OF RANDOM MEASURES
Olav Kallenberg 1978 17 p refs
(CTH-Math-1978-2) Avail: NTIS HC A02/MF A01

The basic theorem states that the L sub p intensity of a random measure eta exists and is locally finite if and only if E eta exists and eta is a.s. absolutely continuous with respect to E eta. The L sub p intensity can be obtained as the limit of finite sums. In the context of particle systems, eta arises as the conditional intensity of a simple point process describing the states of individual particles in phase space. In an example L sub p intensities help analyze convergence in an ergodic flow where particles move independently on the line with fixed velocity. Author (ESA)

N79-24705# Montpellier Univ. (France). Dept. of Physique Mathematique.
NONLINEAR EVOLUTION EQUATIONS ASSOCIATED WITH A MASSIVE DIRAC SYSTEM
M. Jaulent and J. J. P. Leon Jun. 1978 9 p refs
(PM/78/5) Avail: NTIS HC A02/MF A01

An application of the inverse scattering method for solving nonlinear equations is given. The scattering problem for the Zakharov-Shabat system is discussed. The parameter m is a positive scalar, reducing to zero in the regular case. Transformation to a one-dimensional analogue of the radial Dirac system with mass m or to a 2 x 2 matrix Schroedinger equation is shown. The inverse problem and the inverse scattering method are discussed as examples. Author (ESA)

N79-24706# Oxford Univ (England). Engineering Lab.
NON-LINEAR MODEL FITTING AND FUNCTION MINIMISATION PACKAGE
D. W. Clarke 1977 21 p refs
(OUEL-1194/77) Avail: NTIS HC A02/MF A01

The theoretical foundations and practical application of three computer subroutines written for FORTRAN compilers are described. The programs enable the estimation and testing of parameters for nonlinear models and the calculation of least-square solutions for multivariable functions. Examples of the application of the subroutine to actual data sets are provided. Author (ESA)

N79-24707# Oxford Univ. (England). Engineering Lab.
A CONVERGENCE PROOF FOR CONSTRAINED FINITE ELEMENT SOLUTIONS
J. R. Turner 1977 14 p refs
(OUEL-1223/77) Avail: NTIS HC A02/MF A01

A convergence proof is given for the finite-element solution of the infinite dimensional quadratic programming problem of minimizing a quadratic functional subject to linear constraints. The proof for the unconstrained problem is briefly reviewed, and then extended to the constrained case. Only the first part of the proof is given, in which necessary conditions for convergence are derived for the specific problem and its finite-element approximation. The final step of proving that any problem does obey these conditions will depend on the specific problem, but it is shown that if the finite element formulation is pointwise convergent and the unconstrained problem is convergent, then so too will be the constrained problem. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-24708 Temple Univ., Philadelphia, Pa.
WAITING TIMES AND RETURN PERIODS RELATED TO ORDER STATISTICS Ph.D. Thesis
Roberta Diane Small Wenocur 1978 148 p
Avail: Univ. Microfilms Order No. 7910095

Known results for waiting times and return periods to exceed fixed values are extended to the case of waiting times W sub N,j and return periods E (W sub N,j) to exceed the jth order statistic of a random sample of size N, taken from a continuous distribution. A detailed analysis is presented for the case of the extremes, the maximum and minimum of the random sample; expected waiting times to exceed the maximum are analyzed with respect to available information, and a comparison to the theory of record times is offered. The distribution of X W sub N,N the future trial at which the maximum is first exceeded, is examined. Dissert. Abstr.

N79-24709 Temple Univ., Philadelphia, Pa.
PARTIALLY BALANCED RESIDUAL EFFECTS DESIGNS Ph.D. Thesis
Earnest Atwell Blaisdell, Jr. 1979 120 p
Avail: Univ. Microfilms Order No. 7910034

Some restrictions were taken into account, and partially balanced residual effects designs (PBRED) was defined. This definition is a formal mathematical approach to the entire problem of developing residual effects designs, and the balanced residual effects designs form a special case of this definition. These designs were studied systematically. The maximum efficiencies for the estimated direct and residual elementary treatment contrasts of PBREDs were determined, and the A- optimality in the sense of Kiefer of these designs was explored. It was shown that the maximum efficiencies are attained in the case of balanced residual effects designs. The efficiencies of the PBREDs constructed were compared with these bounds. Dissert. Abstr.

N79-24710 Carnegie-Mellon Univ., Pittsburgh, Pa.
FURTHER THEORY OF STABLE DECISIONS Ph.D. Thesis
David Tsao-pin Chuang 1978 103 p
Avail: Univ. Microfilms Order No. 7909873

In a decision problem, a Bayesian has a loss function L approaching infinity theta, D), a likelihood function l(x/theta) and a prior opinion F approaching infinity (theta). A Bayesian makes a decision by minimizing expected loss. Assuming the likelihood function is fixed and agreed upon, this thesis examines the influence of small variations in loss function and prior opinion. Dissert. Abstr.

N79-24711 Connecticut Univ., Storrs.
BIVARIATE NONPARAMETRIC TESTS FOR THE ONE-SAMPLE LOCATION PROBLEM Ph.D. Thesis
Eleanor Jacquelin Dietz 1978 130 p
Avail: Univ. Microfilms Order No. 7911359

Let (X sub i, Y sub i),i = 1,2...,n, be a sample of independent bivariate observations from a population with an absolutely continuous distribution function (x,y). Let f(x,y) be the associated density function and assume that f is symmetric about (theta sub 1, theta sub 2) in the sense that f (theta sub 1+X, theta sub 2+Y) = f(theta sub 1-X, theta sub 2-Y) for all x and y. Consider testing the hypothesis H sub 0: (theta sub 1, theta sub 2) = (0,0) against the alternative H sub 1: (theta sub 1, theta sub2)/(0,0). Dissert. Abstr.

N79-24712 North Carolina Univ. at Chapel Hill.
WEAK CONVERGENCE OF PROGRESSIVELY CENSORED LIKELIHOOD RATIO PROCESSES Ph.D. Thesis
Joseph Chitranjan Gardiner 1978 154 p
Avail: Univ. Microfilms Order No. 7910155

The asymptotic normality of a class of time-sequential statistics arising in progressively censored schemes is obtained. This provides for the asymptotic normality of certain stopping variables. Applications of these results to statistics arising in life testing are given. Dissert. Abstr.

N79-24713 Rutgers - The State Univ., New Brunswick, N. J.
HYPOTHESIS TESTING FOR THE COMMON MEAN OF TWO NORMAL DISTRIBUTIONS WITH UNKNOWN VARIANCES WHEN THE NULL AND ALTERNATIVE HYPOTHESES ARE SEPARATED BY A ZONE OF INDIFFERENCE Ph.D. Thesis
Steven Klein 1978 107 p
Avail: Univ. Microfilms Order No. 7910404

The problem of inference of the common mean of two normal populations with unknown variances where independent, random samples were drawn from each population was investigated. Under certain restrictions on the parameter space, the t-test may be dominated by a two sample test. However, the impossibility of a two sample test which dominated both one sample t-tests simultaneously was shown. But it was possible to achieve such simultaneity of improvement should an additional restriction on the parameter space be present. This restriction was from a pragmatic standpoint, reasonable in that it existed in the important problem of inference concerning treatment effects in balanced incomplete blocks designs with random block effects.
Dissert. Abstr.

N79-24714 Rutgers - The State Univ., New Brunswick, N. J.
PIECEWISE POLYNOMIALS FOR THE PROBABILITY OF CLUSTERING ON THE UNIT INTERVAL Ph.D. Thesis
Norman David Neff 1978 918 p
Avail: Univ. Microfilms Order No. 7910416

Suppose N points are dropped randomly (with independent uniform densities) onto the unit interval. Let P sub n be the length of the smallest interval containing n of the N points. It is known that P(n; N,P) = P(p sub n less than or equal to p) is piecewise polynomial with finitely many pieces. It is shown that P(n; N,P) is a polynomial in p for the domain 0 less than or equal to p less than or equal to 1/([N/n]+[(N-1)/n]), the brackets denoting the greatest integer function. Dissert. Abstr.

N79-24715 Pennsylvania Univ., Philadelphia.
THE POWER OF SEQUENTIAL MODEL SELECTION PROCEDURES Ph.D. Thesis
Jacqueline Oler 1978 330 p
Avail: Univ. Microfilms Order No. 7908776

The following topics are discussed: (1) the likelihood of sequential chi-square goodness-of-fit testing procedures to find the correct model for expected cell frequencies in an m-way cross classification table; and (2) the overall stepwise model selection procedure when more than one test is needed to detect the true model. Dissert. Abstr.

N79-24716 Case Western Reserve Univ., Cleveland, Ohio.
A MODIFIED ROBBINS-MONRO PROCEDURE AND ITS APPLICATIONS Ph.D. Thesis
Aswath Kajana Rao 1979 75 p
Avail: Univ. Microfilms Order No. 7909366

The problem of estimating the zero of a regression function by means of Robbins-Monro type of stochastic approximation procedures is discussed. One of the usual assumptions made in this type of problem is that the regression function is bounded by straight lines. A modified Robbins-Monro type procedure is suggested when this assumption is relaxed. It is shown, under some conditions, that this procedure converges almost surely to the zero and that it can be approximated by sums of independent random variables. An almost sure invariance principle for this procedure is derived. These results are applied to some statistical problems. In particular a power one test for the zero when the slope and variances are known, is suggested. An estimate of the expected sample size for this test is given. The scope of the discussion is restricted to real numbers. A modified Robbins-Monro procedure is suggested when observations are made in a real separable Hilbert space. Dissert. Abstr.

N79-24717 Cornell Univ., Ithaca, N. Y.
INFERENCE AND DECISION MAKING BASED ON INTERVAL-VALUED PROBABILITY Ph.D. Thesis
Marco Wolfenson 1979 145 p
Avail: Univ. Microfilms Order No. 7910792

The central statistical problem of the support lent to a parameter, theta element of circled N, by an observation, x element of X, when the likelihood function is known but no reliable unique prior distribution over circled N is available, was extensively discussed in the literature, and its solutions are still being debated. The approach to this problem uses upper and lower probabilities to express the support (lower probabilities(A), upper probabilities (A)) provided the observation x to A is contained in circled N. The interval-valued support function on circled N is then combined with the utility function U sub a, theta, reflecting the consequences of choosing action, a element of action space, when theta is true parameter value, in order to derive a support function over the action space. Dissert. Abstr.

N79-24718# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.
A STATISTICAL RATIONALE FOR RELATING SITUATIONAL ATTRIBUTES AND INDIVIDUAL DIFFERENCES
Robert G. Demaree, Lawrence R. James, and John J. Hater 31 Jan. 1979 37 p refs
(Contract N00014-76-C-0008; Grants NIDA-H-81-DA-01931; NIDA-R-01-DA-01765)
(AD-A066088; IBR-79-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Statistical rationale is presented for relating specific situational variables (e.g., technological complexity) to individual difference variables, or person variables (e.g., environmental perceptions attitudes). A disaggregation procedure is described wherein unstandardized/standardized regression weights are determined for the regression of a person variable on one or more situational variables. The results of the procedure provide opportunities to ascertain (a) the degree to which variation among individuals on a person variable is associated with situational differences, and (b) the degree to which a situational variable accounts for the total possible variation in the person variable that is associated with situational differences. An important difference between unstandardized and standardized regression weights is noted, and an empirical illustration is presented. Author (GRA)

N79-24719# Naval Postgraduate School, Monterey, Calif.
GENERATION OF NON-HOMOGENEOUS POISSON PROCESSES BY THINNING: PROGRAMMING CONSIDERATIONS AND COMPARISON WITH COMPETING ALGORITHMS M.S. Thesis
John Scott Redd Decj 1978 101 p refs
(AD-A066345) Avail: NTIS HC A06/MF A01 CSCL 12/1

In this thesis we study several computer implementations of the thinning algorithm, a new method for generating non-homogeneous Poisson processes. The method is valid for Poisson processes with any given intensity function. The basic thinning algorithm is modified to exploit several refinements which reduce computer execution time by approximately one-third. The basic and modified thinning programs are compared with the Poisson decomposition and gap-statistics algorithm, which is easily implemented for Poisson processes with intensity functions of the form exp(a sub 0 + a sub 1t + a sub 2 t-squared. The thinning programs are competitive in both execution time and computer memory requirements. One program implementation generates the events in a Poisson process one at a time; another program implements the algorithmic refinements which improve efficiency. GRA

N79-24720# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
CONVERGENCE OF NON-ERGODIC DYNAMIC SYSTEMS
Olav Kallenberg 1977 26 p refs
(CTH-Math-1977-18) Avail: NTIS HC A03/MF A01

Asymptotic behavior was examined both in general and in the particular cases of almost periodic and random rate systems. Results confirm that, while convergence is rather exceptional in the ergodic case, it is the normal behavior for non-ergodic systems. One is a non-trivial extension of Hopf's mixing theorem to the non-ergodic case. Some other propositions are closely related or even analogous to results for line processes and for unbounded systems of non-interacting particles.
Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-24721 State Univ. of New York at Stony Brook.
LIFE GAMES: STATISTICAL, DETERMINISTIC AND COMPUTER APPROACHES IN PHYSICS Ph.D. Thesis
Leslie Lasker 1979 206 p
Avail: Univ. Microfilms Order No. 7911326

A statistical and deterministic approach to explaining physical laws through Conways life games by extending the Dresden-Wong theory is taken. The alive points can be considered to be particles with an effective short-range interaction potential. The use of infinitesimals of non-standard analysis for generation intervals and grid spaces is considered. Dissert. Abstr.

N79-24722 South Carolina Univ., Columbia.
ADAPTIVE OBSERVERS AND CONTROLLERS WITH AN ARBITRARILY FAST EXPONENTIAL RATE OF CONVERGENCE Ph.D. Thesis
Seyhan Nuyan 1978 168 p
Avail: Univ. Microfilms Order No. 7911847

The convergence properties of the adaptive observer of varying complexity are determined. The behavior of the adaptive observer with regard to the choice of design parameters and initial parameter ignorance was examined. The adaptive control problem is considered. An adaptive precompensator scheme using the improved identification techniques is formulated to place the poles of stable, unknown, linear systems to arbitrarily specified locations in the left-half plane. The proposed scheme uses input and output measurements only, has an arbitrarily fast exponential convergence and is totally stable. Dissert. Abstr.

N79-24723 Colorado Univ. at Boulder.
IDENTIFICATION AND ORDER REDUCTION OF DYNAMICAL SYSTEMS Ph.D. Thesis
Abdulaziz Seddik Sherif 1978 157 p
Avail: Univ. Microfilms Order No. 7911474

Three different identification schemes are presented to determine the unknown parameters of single-input single-output linear discrete or continuous systems, and multiple-input multiple-output linear time invariant continuous systems from input/state or input/output data. Two of the presented schemes can be applied to determine the unknown parameters of certain classes of linear time-varying and nonlinear systems. One of the important by-products of these schemes was that the system order and initial conditions can be determined, hence the system order was not required to be known a priori. Another by-product of this scheme was that a reduced order model of a given high order system can be obtained. In the case of all the three schemes, no special test signal was required, only simple noniterative, matrix computations were required, hence these schemes can be used for on-line identification. Dissert. Abstr.

N79-24724# Oxford Univ. (England). Engineering Lab.
A NYQUIST TYPE CRITERION FOR INPUT/OUTPUT STABILITY OF LINEAR TIME-INVARIANT SYSTEMS
J. M. E. Valenca and C. J. Harris 1978 28 p refs
(OUEL-1240/78) Avail: NTIS HC A03/MF A01

L sub 2 stability on n-input m-output linear time-invariant feedback systems is considered. A proof that the ring of all linear, continuous operators mapping L sub 2 into itself is isomorphic to a commutative ring K(0) of holomorphic and bounded complex functions in the open right half plane is shown. Necessary and sufficient conditions for stability of n-input n-output systems are then derived from the conditions of invertibility of matrices over the ring K (0). A comprehensive analysis is given of the geometaic interpretation of the stability conditions leading to a generalized Nyquist criterion. Results show that these geometric properties can be deduced from simple encirclement conditions in the plane involving the loci of the eigenvalues of a matrix A over K(0). Author (ESA)

N79-24732*# Naval Observatory, Washington, D. C.
INTRODUCTION TO SYSTEMS APPROACH
Gernot M. R. Winkler *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 1-15 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-24725 North Carolina Univ. at Chapel Hill.
PROJECTIONS AND MEASURES Ph.D. Thesis
Cecilia Ann Hartley Brook 1978 150 p
Avail: Univ. Microfilms Order No. 7910140

Continuity and orthogonality of vector measures are studied, and a general Lebesgue decomposition is proved. If the ring is a rho-algebra, then continuity of measures is related to order continuity and to the countable chain condition. Six descriptions are presented of the complete Boolean algebra of projections. Projections are realized as equivalence classes of measures, L-projections, clopen sets, extreme points, closed ideals, and equivalence classes of universally measurable sets. Applications are given to Boolean algebras and Stone spaces. Dissert. Abstr.

N79-24726# Brown Univ., Providence, R. I. Center for Dynamical Systems.
SOME PROPERTIES OF CONDENSING MAPS Interim Report. Ph.D. Thesis
Paul Massatt Dec. 1978 30 p refs
(Contract AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A065630; AFOSR-79-0111TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A measure of noncompactness of bounded sets in a metric space was introduced which was called Kuratowskii measure of noncompactness, or 2-measure. This concept along with the associated notion of an alpha-contraction, has proved useful in several areas of differential equations. GRA

N79-24727# California Univ., Berkeley. Lawrence Berkeley Lab.
LIE TRANSFORMS AND THEIR USE IN HAMILTONIAN PERTURBATION THEORY
J. R. Cary Jun. 1978 62 p refs
(Contract W-7405-eng-48)
(DOE/ET-0074) Avail: NTIS HC A04/MF A01

The theory of Lie transforms as applied to Hamiltonian systems is reviewed. General background on the Hamiltonian formalism is presented and operator notation for canonical transformations is discussed. The general theory of transforms and the formula for the Hamiltonian when one uses a Lie transform to effect a canonical transformation are derived. Lie transforms are used to prove a very general version of Noether's theorem, or the symmetry-equals-invariant theorem. The perturbation theory is illustrated by application to two well-known problems in classical mechanics. DOE

N79-24728# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
A REFINEMENT OF LEBESGUE'S MEASURE DECOMPOSITION
Olav Kallenberg 1978 10 p refs
(CTH-Math-1978-1) Avail: NTIS HC A02/MF A01

According to Lebesgue's classical result, every measure mu on R admits a unique decomposition mu = mu sub C + mu sub S + mu sub A, where mu sub c is absolutely continuous, mu sub s is diffuse but singular, and mu sub A is purely atomic. Certain regularity conditions which arise naturally in the context of stochastic particle systems are shown to induce a further decomposition of mu sub S into three parts. The resulting decomposition is persistent under absolute continuity as well as under addition and monotone convergence. Author (ESA)

N79-24729# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON RATIONAL APPROXIMATIONS OF SEMIGROUPS
Philip Brenner and Vidar Thomee 1978 25 p refs
(CTH-Math-1978-3) Avail: NTIS HC A02/MF A01

It is proven that the norms of A- acceptable rational approximations of a strongly continuous semigroup E exp (tA) are bounded. If t is bounded, then there exists a constant such that the nth approximation does not exceed in norm, the constant times the square root of n. The error term is estimated. The order of convergence is a piecewise linear function of the degree of smoothness of the data. The proof utilizes Hille-Phillips operational calculus and the Fourier multiplier norm which is estimated locally by Carlson's inequality. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-24730 Colorado Univ. at Boulder.
PERTURBATION THEORY OF SOME NONLINEAR PROBLEMS IN MECHANICS OF SOLIDS, FLUIDS, AND PLASMAS Ph.D. Thesis
Bhimsen Krishnarao Shivamoggi 1978 142 p
Avail: Univ. Microfilms Order No. 7911473

The method of strained parameters and the method of multiple scales are applied to a variety of singular perturbation problems of physical interest in mechanics of solids, fluids, and plasmas. Topics covered include: (1) nonlinear buckling of elastic columns; (2) nonlinear dynamic buckling of a thin elastic plate; (3) nonlinear inextensional deformation of a spherical shell; (4) wave propagation in an inhomogeneous medium; (5) nonlinear hyperbolic waves in a gas; (6) effect of rotation on flow past a flat plate due to a standing sound field; (7) Lighthill's theory of aerodynamically generated sound; (8) nonlinear Rayleigh-Taylor instability of superposed fluids; (9) linear and nonlinear waves in Kelvin-Helmholtz flow; (10) adiabatic invariants of a gyrating charged particle; (11) propagation of hydromagnetic waves in a slightly non-uniform magnetic field; (12) nonlinear stability of surface waves in electrohydrodynamics. Dissert. Abstr.

N79-24731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE TENTH ANNUAL PRECISE TIME AND TIME INTERVAL (PTTI) APPLICATIONS AND PLANNING MEETING
Nov. 1978 811 p refs Meeting held at NRL, Washington, D. C., 28-30 Nov. 1978; sponsored in part by Naval Electronic Systems Command, NRL, Naval Observatory and Defense Communications Agency
(NASA-TM-80250) Avail: NTIS HC A99/MF A01 CSCL 12B

Time measurement, frequency standards and clock synchronization are discussed in terms of application to navigation and communication. Emphasis is placed on satellite applications. For individual titles, see N79-24732 through N79-24760.

N79-24732*# Naval Observatory, Washington, D. C.
INTRODUCTION TO SYSTEMS APPROACH **c66**
Gernot M. R. Winkler *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 1-15 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

Main aspects of systems theory are outlined. Emphasis is on the interface of between time and systems - natural or artificial. J.M.S.

N79-24733*# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
COMPOSITE OSCILLATOR SYSTEMS FOR MEETING USER NEEDS FOR TIME AND FREQUENCY **c33**
S. R. Stein and F. L. Walls *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. Planning Meeting Nov. 1978 p 17-35 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09A

Frequency standards are used in most navigation and telecommunications systems to provide a long term memory of either frequency, phase, or time epoch. From a systems point of view, the performance aspects of the frequency standard are weighed against other systems characteristics, such as overall performance, cost, size, and accessibility; a number of examples are very briefly reviewed. The theory of phase lock and frequency lock systems is outlined in sufficient detail that total oscillator system performance can be predicted from measurements on the individual components. As an example, details of the performance of a high spectral purity oscillator phase locked to a long term stable oscillator are given. Results for several systems, including the best system stability that can be obtained from present commercially available 5-MHz sources, are shown. J.M.S.

N79-24734*# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
RELATIONSHIPS BETWEEN THE PERFORMANCE OF TIME/FREQUENCY STANDARDS AND NAVIGATION/COMMUNICATION SYSTEMS
H. Hellwig, S. R. Stein, F. L. Walls, and A. Kahan (RADC, Hanscom AFB, Mass.) *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 37-53 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

The relationship between system performance and clock or oscillator performance is discussed. Tradeoffs discussed include: short term stability versus bandwidth requirements; frequency accuracy versus signal acquisition time; flicker of frequency and drift versus resynchronization time; frequency precision versus communications traffic volume; spectral purity versus bit error rate, and frequency standard stability versus frequency selection and adjustability. The benefits and tradeoffs of using precise frequency and time signals are various levels of precision and accuracy are emphasized. J.M.S.

N79-24735*# Frequency and Time Systems, Inc., Danvers, Mass.
ACCELERATION SENSITIVITY COMPENSATION IN HIGH PERFORMANCE CRYSTAL OSCILLATORS **c33**
Donald A. Emmons *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 55-83 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09A

Two approaches to achieving reduced acceleration sensitivity of crystal oscillators are discussed. The first involves electronic compensation within the frequency control loop. The second utilizes two resonators of comparable acceleration sensitivity to compensate each other. Problems encountered in matching and tuning the resonators are discussed, as well as orientation symmetry of the frequency deviation patterns. Results on frequency stability which reflect an improved static sensitivity are presented. J.M.S.

N79-24736*# Space and Missile Test Center, Vandenburg AFB, Calif.
PRECISE TERRESTRIAL TIME: A MEANS FOR IMPROVED BALLISTIC MISSILE GUIDANCE ANALYSIS
Eldon E. Ehrsam, Stephen A. Cresswell (ITT Federal Electric Corp.), George R. Mckelvey (ITT Federal Electric Corp.), and Frank L. Matthews (ITT Federal Electric Corp.) *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 85-100 ref (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

An approach developed to improve the ground instrumentation time tagging accuracy and adapted to support the Minuteman ICBM program is desired. The Timing Insertion Unit (TIU) technique produces a telemetry data time tagging resolution of one tenth of a microsecond, with a relative intersite accuracy after corrections and velocity data (range, azimuth, elevation and range rate) also used in missile guidance system analysis can be correlated to within ten microseconds of the telemetry guidance data. This requires precise timing synchronization between the metric and telemetry instrumentation sites. The timing synchronization can be achieved by using the radar automatic phasing system time correlation methods. Other time correlation techniques such as Television (TV) Line-10 and the Geostationary Operational

Environmental Satellites (GEOS) terrestial timing receivers are also considered. J.M.S.

N79-24737*# Ecole Nationale Superieure de Chimie de Paris (France).
QUARTZ CRYSTAL AND SUPERCONDUCTIVE RESONATORS AND OSCILLATORS c33
Raymond S. Besson *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 101-130 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

A general overview of piezoelectric resonators is given with emphasis on evolution of the resonator design. Superconducting cavities and crystals at low temperature and the use of resonant frequencies are also discussed. J.M.S.

N79-24738*# Naval Research Lab., Washington, D. C.
SHIELDING OF LONGITUDINAL MAGNETIC FIELDS WITH THIN, CLOSELY, SPACED CONCENTRIC CYLINDRICAL SHELLS WITH APPLICATIONS TO ATOMIC CLOCKS c32
S. A. Wolf, D. U. Gubser, and J. E. Cox *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 131-146 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

A general formula is given for the longitudinal shielding effectiveness of N closed concentric cylinders. The use of these equations is demonstrated by application to the design of magnetic shields for hydrogen maser atomic clocks. Examples of design tradeoffs such as size, weight, and material thickness are discussed. Experimental results on three sets of shields fabricated by three manufacturers are presented. Two of the sets were designed employing the techniques described. Agreement between the experimental results and the design calculations is then demonstrated. J.M.S.

N79-24739*# Efratom Systems Corp., Irvine, Calif.
ELIMINATION OF THE LIGHT SHIFT IN RUBIDIUM GAS CELL FREQUENCY STANDARDS USING PULSED OPTICAL PUMPING
Thomas C. English, Ernst Jechart, and T. M. Kwon *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 147-168 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

Changes in the intensity of the light source in an optically pumped, rubidium, gas cell frequency standard can produce corresponding frequency shifts, with possible adverse effects on the long-term frequency stability. A pulsed optical pumping apparatus was constructed with the intent of investigating the frequency stability in the absence of light shifts. Contrary to original expectations, a small residual frequency shift due to changes in light intensity was experimentally observed. Evidence is given which indicates that this is not a true light-shift effect. Preliminary measurements of the frequency stability of this apparatus, with this small residual pseudo light shift present, are presented. It is shown that this pseudo light shift can be eliminated by using a more homogeneous C-field. This is consistent with the idea that the pseudo light shift is due to inhomogeneity in the physics package (position-shift effect). J.M.S.

N79-24740*# Frequency and Time Systems, Inc., Danvers, Mass.
PERFORMANCE OF PREPRODUCTION MODEL CESIUM BEAM FREQUENCY STANDARDS FOR SPACECRAFT APPLICATIONS
Martin W. Levine *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 169-220 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

A cesium beam frequency standards for spaceflight application on Navigation Development Satellites was designed and fabricated and preliminary testing was completed. The cesium standard evolved from an earlier prototype model launched aboard NTS-2 and the engineering development model to be launched aboard NTS satellites during 1979. A number of design innovations, including a hybrid analog/digital integrator and the replacement of analog filters and phase detectors by clocked digital sampling techniques are discussed. Thermal and thermal-vacuum testing was concluded and test data are presented. Stability data for 10 to 10,000 seconds averaging interval, measured under laboratory conditions, are shown. J.M.S.

N79-24741*# Laval Univ. (Quebec). Lab. d'Electronique Quantique.
TIME DOMAIN MEASUREMENT OF FREQUENCY STABILITY: A TUTORIAL INTRODUCTION
Jacques Vanier and Michel Tetu *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 247-291 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09E

The theoretical basis behind the definition of frequency stability in the time domain is outlined. Various types of variances were examined. Their differences and interrelation are pointed out. Systems that are generally used in the measurement of these variances are described. J.A.M.

N79-24742*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODULAR MULTIPLE USE SYSTEM FOR PRECISE TIME AND FREQUENCY MEASUREMENT AND DISTRIBUTION
Victor S. Reinhardt, William S. Adams, Grace M. Lee, and Robert L. Bush (Bendix Field Engineering Corp., Greenbelt, Md.) *In its* Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 293-315 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09E

A modular CAMAC based system is described which was developed to meet a variety of precise time and frequency measurement and distribution needs. The system was based on a generalization of the dual mixer concept. By using a 16 channel 100 ns event clock, the system can intercompare the phase of 16 frequency standards with subpicosecond resolution. The system has a noise floor of 26 fs and a long term stability on the order of 1 ps or better. The system also used a digitally controlled crystal oscillator in a control loop to provide an offsettable 5 MHz output with subpicosecond phase tracking capability. A detailed description of the system is given including theory of operation and performance. A method to improve the performance of the dual mixer technique is discussed when phase balancing of the two input ports cannot be accomplished. J.A.M.

N79-24743*# Naval Electronic Systems Command, Washington, D. C.
A REVIEW OF THE US NAVY'S PRECISE TIME AND TIME INTERVAL (PTTI) PROGRAM
Ralph T. Allen *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 317-340 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

The history of the Navy's PTTI Program is outlined, as well as projected PTTI requirements and capabilities. Current and Projected Program efforts were also considered. Simplified diagrams of the user system are provided. J.A.M.

N79-24744*# Hewlett-Packard Co., Santa Clara, Calif.
FREQUENCY DOMAIN MEASUREMENT SYSTEMS
Michael C. Eischer *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 341-377 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 09E

Stable frequency sources and signal processing blocks were characterized by their noise spectra, both discrete and random, in the frequency domain. Conventional measures are outlined, and systems for performing the measurements are described. Broad coverage of system configurations which were found useful is given. Their functioning and areas of application are discussed briefly. Particular attention is given to some of the potential error sources in the measurement procedures, system configura-

tions, double-balanced-mixer-phase-detectors, and application of measuring instruments. J.A.M.

N79-24745*# Rockwell International Corp., Anaheim, Calif. Electronic Systems Group.
RUBIDIUM FREQUENCY STANDARD TEST PROGRAM FOR NAVSTAR GPS c04
Frank Koide and Darrell J. Dederich *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 379-392 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17G

Test data of the RFS Program in the Production phase and computer automation are presented, as an essential element in the evaluation of the RFS performance in a simulated spacecraft environment. Typical production test data will be discussed for stabilities from 1 to 100,000 seconds averaging time and simulated time error accumulation test. Also, design considerations in developing the RFS test systems for the acceptance test in production are discussed. J.A.M.

N79-24746*# Defense Communications Engineering Center, Reston, Va.
OVERVIEW OF TIMING/SYNCHRONIZATION FOR DIGITAL COMMUNICATIONS c32
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 393-403 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

Systems in general, and switched systems in particular, are explained. It pointed out some of the criteria that greatly influence timing/synchronization subsystem design for a military communications network but have little or no significance for civil systems. Timing techniques were evaluated in terms of fundamental features. Different combinations of these features covered most possibilities from which a synchronous timing system could be chosen. J.A.M.

N79-24747*# NEC American, Inc., Dallas, Tex.
SURVEY OF TIMING/SYNCHRONIZATION OF OPERATING WIDEBAND DIGITAL COMMUNICATIONS NETWORKS c32
Ronald L. Mitchell (Electrospace Systems, Inc.) *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 405-435 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

In order to benefit from experience gained from the synchronization of operational wideband digital networks, a survey was made of three such systems: Data Transmission Company, Western Union Telegraph Company, and the Computer Communications Group of the Trans-Canada Telephone System. The focus of the survey was on deployment and operational experience from a practical (as opposed to theoretical) viewpoint. The objective was to provide a report on the results of deployment how the systems performed, and wherein the performance differed from that predicted or intended in the design. It also attempted to determine how the various system designers would use the benefit of hindsight if they could design those same systems today. Author

N79-24748*# Harris Corp., Melbourne, Fla.
AN EVALUATION OF OPTIONAL TIMING/SYNCHRONIZATION FEATURES TO SUPPORT SELECTION OF AN OPTIMUM DESIGN FOR THE DCS DIGITAL COMMUNICATION NETWORK c32
D. B. Bradley, J. B. Cain, III, and M. W. Williard *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 437-461 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

The task was to evaluate the ability of a set of timing/synchronization subsystem features to provide a set of desirable characteristics for the evolving Defense Communications System digital communications network. The set of features related to the approaches by which timing/synchronization information could be disseminated throughout the network and the manner in which this information could be utilized to provide a synchronized network. These features, which could be utilized in a large number of different combinations, included mutual control, directed control, double ended reference links, independence of clock error measurement and correction, phase reference combining, and self organizing. J.A.M.

N79-24749*# Harris Corp., Melbourne, Fla.
EFFECT OF VARIOUS FEATURES ON THE LIFE CYCLE COST OF THE TIMING/SYNCHRONIZATION SUBSYSTEM OF THE DCS DIGITAL COMMUNICATIONS NETWORK c32
D. B. Kimsey *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 463-489 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 17B

The effect on the life cycle cost of the timing subsystem was examined, when these optional features were included in various combinations. The features included mutual control, directed control, double-ended reference links, independence of clock error measurement and correction, phase reference combining, self-organization, smoothing for link and nodal dropouts, unequal reference weightings, and a master in a mutual control network. An overall design of a microprocessor-based timing subsystem was formulated. The microprocessor (8080) implements the digital filter portion of a digital phase locked loop, as well as other control functions such as organization of the network through communication with processors at neighboring nodes. J.A.M.

N79-24750*# Naval Surface Weapons Center, Dahlgren, Va.
CLOCK PERFORMANCE AS A CRITICAL PARAMETER IN NAVIGATION SATELLITE SYSTEMS
Richard J. Anderle *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 491-510 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 13B

The high performance of available oscillators has permitted the development of invaluable navigation and geodetic satellite systems. However, still higher performance oscillators would further improve the accuracy or flexibility of the systems. Author

N79-24751*# Navy Astronautics Group, Point Mugu, Calif.
TRANSIT SATELLITE SYSTEM TIMING CAPABILITIES c15
Theodore D. Finsod *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 511-535 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 22B

Current time transfer capabilities of the Transit Satellite System are reviewed. Potential improvements in the changes in equipment and operational procedures using operational satellites are discussed. S.E.S.

N79-24752*# International Latitude Observatory, Mizusawa (Japan).
TIME SYNCHRONIZATION VIA THE TRANSIT SATELLITE AT MIZUSAWA
J. Hara and K.-H. Sato *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 537-547 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A09/MF A01 CSCL 12B

Time signals emitted from Transit satellites and received by the NAVICODE type receiver at Mizusawa, Japan are presented. The International Latitude Observatory of Mizusawa and the U. S. Naval Observatory were compared using the time signals. Propagation delays, a receiver delay, effects of relative motion of satellites, and effects of the ionosphere are discussed. S.E.S.

N79-24753*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
DOWN TO EARTH RELATIVITY
Irwin I. Shapiro *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl.

and Planning Meeting Nov. 1978 p 549-568 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

The basic concepts of the special and general theories of relativity are described. Simple examples are given to illustrate the effect of relativity on measurements of time and frequency in the near-earth environment. Author

N79-24754*# National Geodetic Survey, Rockville, Md.
MODERN METHODS FOR THE DETERMINATION OF POLAR MOTION AND UT1
William S. Carter *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 569-583 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

The applications and Doppler satellite observations, laser ranging to artificial satellites and the Moon, and astronomic radio interferometry to monitoring polar motion and Universal Time System 1 (UT1) are discussed. How and what each method is capable of measuring, fundamental limitations, and the present status of the developments of each method were reviewed. Evaluations of the various methods as candidates for the next generation international polar motion and UT1 monitoring service are summarized. S.E.S.

N79-24755*# National Research Council of Canada, Ottawa (Ontario). Time and Frequency Section.
TWO-WAY TIME TRANSFERS BETWEEN NRC/NBS AND NRC/USNO VIA THE HERMES (CTS) SATELLITE
C. C. Costain, H. Daams, J. S. Boulanger, D. W. Hanson, and W. J. Klepczynski *In* NASA. Goddard Space Flight Center Proc. of the Tenth Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 585-600 refs Prepared in cooperation with NBS, Boulder, Colo., and US Naval Observatory, Washington, D. C. (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

At each station the differences were measured between the local UTC seconds pulse and the remote UTC pulse received by satellite. The difference between the readings, if station delays are assumed to be symmetrical, is two times the difference between the clocks at the two ground station sites. Over a 20-minute period, the precision over the satellite is better than 1 ns. The time transfer from NRC to the CRC satellite terminal near Ottawa and from NBS to the Denver HEW terminal was examined. S.E.S.

N79-24756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUBMICROSECOND COMPARISONS OF TIME STANDARDS VIA THE NAVIGATION TECHNOLOGY SATELLITES (NTS)
J. Buisson (Naval Research Lab., Washington, D. C.), T. McCaskill (Naval Research Lab., Washington, D. C.), J. Oaks (Naval Research Lab., Washington, D. C.), D. Lynch, S. C. Wardrip (Applied Physics Lab., Johns Hopkins Univ.), and G. Whitworth *In its* Proc. of the 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1978 p 601-627 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

An interim demonstration was performed of the time transfer capability of the NAVSTAR GPS system using a single NTS satellite. Measurements of time difference (pseudo-range) are made from the NTS tracking network and at the participating observatories. The NTS network measurements are used to compute the NTS orbit trajectory. The central NTS tracking station has a time link to the Naval Observatory UTC (USNO,MC1) master clock. Measurements are used with the NTS receiver at the remote observatory, the time transfer value UTC (USNO,MC1)-UTC (REMOTE, VIA NTS) is calculated. Intercomparisons were computed using predicted values of satellite clock offset and ephemeus. S.E.S.

N79-24757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUBMICROSECOND COMPARISON OF INTERNATIONAL CLOCK SYNCHRONIZATION BY VLBI AND THE NTS SATELLITE
William J. Hurd (JPL, Pasadena), Schuyler C. Wardrip, Jim Bussion (NRL, Washington, D. C.), Jay Oaks (NRL, Washington, D. C.), Thomas McCaskill (NRL, Washington, D. C.), Hugh Warren (Bendix Field Engineering Corp.), and Gary Whitworth (Applied Physics Lab., Johns Hopkins Univ.) *In its* Proc. of the 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1979 p 629-642 refs (For primary document see N79-24731 15-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 12B

The intercontinental clock synchronization capabilities of Very Long Baseline Interferometry (VLBI) and the Navigation Technology Satellite (NTS) were compared using both methods to synchronize the Cesium clocks at the NASA Deep Space Net complexes at Madrid, Spain and Goldstone, California. Verification of the accuracy of both systems was examined. The VLBI experiments used the Wideband VLBI Data Acquisition System developed at the NASA Jet Propulsion Laboratory. The NTS Satellites were designed and built by the Naval Research Laboratory used with NTS Timing Receivers developed by the Goddard Space Flight Center. The two methods agreed at about the one-half microsecond level. S.E.S.

N79-24758*# National Physical Lab., New Delhi (India).
CLOCK SYNCHRONISATION EXPERIMENT IN INDIA USING SYMPHONIE SATELLITE
Y. V. Somayajulu, B. S. Mathur, P. Banerjee, S. C. Garg, Lakha Singh, P. C. Sood, Tuhi Ram Tyagi, C. L. Jain (Space Applications Centre, India), and K. Kumar (Space Applications Centre, India) *In* NASA. Goddard Space Flight Center Proc. of the 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1979 p 643-658 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

A recent clock synchronization experiment between the National Physical Laboratory (NPL), New Delhi and Space Applications Center (SAC), Ahemedabad, in India via geostationary satellite symphonie 2, stationed at 49 E longitude, is reported. A two-way transmission using a microwave transponder considered to provide the greatest precision in synchronization of two remote clocks is described. S.E.S.

N79-24759*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PTTI APPLICATIONS TO DEEP SPACE NAVIGATION c17
David W. Curkendall *In* NASA. Goddard Space Flight Center Proc. of 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1979 p 659-691 refs (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 22A

Radio metric deep space navigation relies nearly exclusively upon coherent, two way, Doppler and ranging for all precise applications. These data types and the navigational accuracies they can produce are reviewed. The deployment of hydrogen maser frequency standards and the development of Very Long Baseline Interferometry (VLBI) systems within the Deep Space Network are used in the development of non-coherent, one way data forms that promise much greater inherent navigational accuracy. The underlying structure between each data class and clock performance is charted. VLBI observations of the natural radio sources are the planned instrument for the synchronization task. This method and a navigational scheme using differential measurements between the spacecraft and nearby quasars are described. S.E.S.

N79-24760*# Naval Research Lab., Washington, D. C.
TEMPUS: A PROPOSAL FOR INTERNATIONAL TIME TRANSFER AND PRECISION TRACKING SATELLITE
David C. Holmes *In* NASA. Goddard Space Flight Center Proc. of the 10th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting Nov. 1979 p 693-707 (For primary document see N79-24731 15-70)
Avail: NTIS HC A99/MF A01 CSCL 12B

Very Long Baseline Interferometry (pulsars), Television relay via satellite, portable clocks, Navigation Technology Satellite, and Loran C are described and compared. S.E.S.

N79-24761# Cornell Univ., Ithaca, N. Y. Baker Lab.
SUPERCONDUCTIVITY IN NONSTOICHIOMETRIC COMPOUNDS, LAYERS, AND CHALCOGEN TERNARIES Final Report, 1 Jan. 1974 - 31 Dec. 1978
M. J. Sienko 1 Feb. 1979 39 p refs
(Grant AF-AFOSR-2583-74; AF Proj. 2306)
(AD-A065668; AFOSR-79-0207TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

The objective of this research was to study the effect of chemical composition on superconductivity in chemical compounds. Four kinds of compounds were investigated: tunnel-structure tungsten bronzes, covalent-frame hexaborides, layered-structure transition metal dichalcogenides, and Chevrel-type molybdenum ternaries. In the tungsten bronzes, it was found that changing electron density was less important than enhancing electron-phonon coupling, by approach to a crystallographic structure change boundary. In the metal hexaborides, it was shown that lattice expansion was less effective than decreasing conduction electron density in depressing the superconducting critical temperature, but even more effective was the presence of magnetic ions in the metal sublattice. This was found to be the most likely reason for the very low critical temperature of lanthanum hexaboride. In the layered dichalcogenides, insertion of magnetic ions between the layers was found to be less effective in depressing critical temperature than either substitution of magnetic ions within the layers or departure from stoichiometry. The latter was found to lead to a change in polytype which could be correlated with the onset temperature of a charge density wave. In the Chevrel-type compounds, a new correlation was found between superconducting critical temperature, c/a lattice parameter ratio, and deviation from stoichiometry.
Author (GRA)

N79-24762# Colorado Univ., Boulder. Dept. of Electrical Engineering.
DIFFRACTION BY A DIELECTRIC WEDGE Final Report
L. Lewin and I. Sreenivasiah Jan. 1979 184 p refs
(Contract N00014-76-C-0783)
(AD-A065699) Avail: NTIS HC A09/MF A01 CSCL 20/3

Three separate investigations were made. The first, based on a spectral decomposition method, was the one on which the contract proposal was originally based. It turned out to have a built-in flaw, which was not discovered, however, until rather late in the analysis. As a consequence the method was abandoned. Just at that time, attention was drawn to two Soviet papers, both of which claimed to have solved the wedge problem rigorously and completely, though by completely different methods. The first paper, by Zavadskii, was examined and found to be faulty. Efforts made to correct the errors were to no avail. However, a semitrivial result emerged from these studies which, in retrospect, could have been found by elementary methods. The second paper, by Aleksandrova and Khiznyak, also turned out to be faulty, though the complex analysis involved a great deal of study to pin-point exactly where the errors occurred. It was not found possible to solve the problem by their method with the errors corrected. It appears that at the present time there is still no valid and rigorous solution to the wedge problems, though several approximations, particularly Balling's, have appeared in the literature, and should provide useful results in practical applications. GRA

N79-24763# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LOCAL SITE DISTORTION MODEL OF MAGNETOSTRICTION
Gerald F. Dionne Nov. 1978 28 p refs
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A066250; TR-532; ESD-TR-78-292) Avail: NTIS HC A03/MF A01 CSCL 20/3

A new model is proposed to explain the magnetostriction effects in ferrimagnetic spinels and garnets with Mn(3+), CO(2+), and Fe(2+) ions substituted into octahedral sites. Considerable experimental evidence has revealed that small amounts of each of these ions will alter substantially the magnitude of either the lambda 100 or lambda 111 magnetostriction constant, depending on the particular ion. The theory is based on the concept that Jahn-Teller effects produce local site distortions of tetragonal (favoring (100) axes) or trigonal (favoring (111) axes) symmetry which are able to switch among the different axes of the particular family in order to select the axis closest to the direction of the magnetic field. For Mn(3+) ions, the local site distortions are expected to be tetragonal (c/a = 1). With CO(2+) ions, the distortion is also tetragonal, but of the opposite sign (c/a - 1). In the case of Fe(2+) ions, the distortion is trigonal (alpha - 60 deg), as evidenced by its behavior in FeO, and will produce large positive changes in the lambda 111 constant. In each case studied, the theoretical results are in complete accord with the available room temperature magnetostriction constant data on a qualitative basis. An estimate of the magnitude of the elastic energy of the local site distortion suggests that crystal field energy level splittings required to create the observed magnetostrictive effects are only on the order of .01/cm. GRA

N79-24764# Naval Surface Weapons Center, White Oak, Md.
PERMEABILITY, MAGNETOMECHANICAL COUPLING AND MAGNETOSTRICTION IN GRAIN-ORIENTED RARE EARTH-IRON ALLOYS
H. T. Savage, R. Abbundi, A. E. Clark, and O. D. McMasters 1978 10 p refs Presented at 24th Conf. on Magnetism and Magnetic Materials, Cleveland, Ohio, 14 Nov. 1978
(Contract W-7405-eng-82)
(IS-M-174; Conf-781114-11) Avail: NTIS HC A02/MF A01

A partially oriented TbDyHoFe sample was prepared using a pyrolytic Bridgman type boron nitride crucible. At a bias field of 100 Oe, the mechanical coupling = .73, which is considerably larger than found in the random polycrystal of the same composition. A relative permeability of 36 occurs in this same sample when a low ac drive of 1.6 Oe rms is used. A second fabrication method using a horizontal zone technique with a supporting cold finger was employed to grow the ternary TbDyFe. The low ac drive values of the magnetomechanical coupling and relative permeability were .74 and 19 respectively. The permeability at low bias was found to possess a sharp ac drive dependence. Near zero bias, when the drive was changed from 1.6 Oe rms to 13 Oe rms, the relative permeability in the quaternary increased from 36 to 98. In the ternary, the values of the relative permeability near zero bias increased from 19 to 61. Magnetostriction measurements on both samples show a significant increase in lambda/dH and lambda/sub s/ over the random polycrystals. DOE

N79-24765# Bell Telephone Labs., Inc., Murray Hill, N. J.
CALCULATION OF THE KOLMOGOROV ENTROPY FOR MOTION ALONG A STOCHASTIC MAGNETIC FIELD
A. B. Rechester, M. N. Rosenbluth (Inst. for Advanced Study, Princeton, N. J.), and R. B. White (Princeton Univ., N. J.) Mar. 1979 14 p refs
(Contract EY-76-C-02-3073)
(PPPL-1523) Avail: NTIS HC A02/MF A01

An expression for the Kolmogorov entropy was derived. Agreement between a probability description and direct dynamical computations was found. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-24766 Miami Univ., Coral Gables, Fla.
DEEP OCEAN RECEPTION OF ACOUSTIC SIGNALS EMITTED BY A TOWED SOURCE Ph.D. Thesis
Richard Patrick Flanagan 1978 320 p
Avail: Univ. Microfilms Order No. 7911778

The effects of source motion on an acoustic signal received by an underwater sensor or array were examined using ray theory and time series analysis. The types of motion include the long term passage of a source over several kilometers, and micromotion, defined as the small motions of the acoustic body about its intended direction of motion. Results showed the effect of transducer placement. A deep source (450m) produced a higher signal level but introduced more rapid fluctuations causing the coherence time to drop significantly. Also the coherence time inside of a convergence zone was shown to be less than outside. The coherence bandwidth was only mildly affected by source

position with the deeper source being slightly less frequency dependent. Spectral calculations indicated the micromotion to be responsible for a transfer of power from the expected frequency bins to frequencies located plus or minus T sub mm Hz distant. Dissert. Abstr.

N79-24767 Arizona Univ., Tucson.
TEMPERATURE DEPENDENCE OF THE VELOCITY OF ULTRASOUND IN MAMMALIAN TISSUE Ph.D. Thesis
Richard Leon Nasoni 1978 219 p
Avail: Univ. Microfilms Order No. 7909475

Measurements of the speed of ultrasound as a function of temperature in the 35 C to the 45 C range were made on mammalian tissue both in vitro and in vivo at 5 MHz using a pulsed transmission technique. Cored samples coinciding with the ultrasonically irradiated tissue were obtained and assayed for water, total lipid and collagen content. Temperature profiles were also obtained on animal lipids, lipid acids, triol in and collagen suspensions. A thermal model was developed which accounts for the temperature distribution across the sample and provides the coefficient of thermal diffusivity for the sample. A multiple correlation model was developed and run to explain the effects on the velocity of ultrasound for a given tissue. Results indicate about a two percent agreement between in vivo and in vitro data and that, on the basis of kidney data, temperature, water and lipid fraction explain 76 percent of the variance in velocity. Dissert. Abstr.

N79-24768 Cornell Univ., Ithaca, N. Y.
ACOUSTIC EMISSION AND PROPAGATION OF ELASTIC PULSES IN A PLATE Ph.D. Thesis
Ahmet Nuri Ceranoglu 1979 167 p
Avail: Univ. Microfilms Order No. 7910736

The transient response of an elastic, isotropic, homogeneous infinite plate due to point sources including an arbitrarily oriented concentrated force, single couple, double force, center of rotation, and a double couple without moment is presented. These sources or a distribution of them are used to model the mechanism of acoustic emission which is a phenomenon of rapidly releasing of localized strain energy in solid materials or structures. Numerical results are presented for each force system described. Receiver locations up to six plate thicknesses and response durations up to nine transit time required for a P-wave to cross the thickness were considered in all of the sources. Dissert. Abstr.

N79-24769*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
EVALUATING AND MINIMIZING NOISE IMPACT DUE TO AIRCRAFT FLYOVER Annual Report
Ira D. Jacobson and Gerald Cook May 1979 46 p refs
(Grant NsG-1509)
(NASA-CR-158619; UVA/528166/MAE79/101) Avail: NTIS HC A03/MF A01 CSCL 20A

Existing techniques were used to assess the noise impact on a community due to aircraft operation and to optimize the flight paths of an approaching aircraft with respect to the annoyance produced. Major achievements are: (1) the development of a population model suitable for determining the noise impact, (2) generation of a numerical computer code which uses this population model along with the steepest descent algorithm to optimize approach/landing trajectories, (3) implementation of this optimization code in several fictitious cases as well as for the community surrounding Patrick Henry International Airport, Virginia. A.R.H.

N79-24770*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED METHOD FOR PREDICTING THE EFFECTS OF FLIGHT ON JET MIXING NOISE
James R. Stone 1979 28 p refs Presented at the 97th Meeting of the Acoustical Soc. of America, Cambridge, Mass., 11-15 Jun. 1979
(NASA-TM-79155; E-011) Avail: NTIS HC A02/MF A01 CSCL 20A

The NASA method (1976) for predicting the effects of flight on jet mixing noise was improved. The earlier method agreed reasonably well with experimental flight data for jet velocities up to about 520 m/sec (approximately 1700 ft/sec). The poorer agreement at high jet velocities appeared to be due primarily to the manner in which supersonic convection effects were formulated. The purely empirical supersonic convection formulation of the earlier method was replaced by one based on theoretical considerations. Other improvements of an empirical nature included were based on model-jet/free-jet simulated flight tests. The revised prediction method is presented and compared with experimental data obtained from the Bertin Aerotrain with a J85 engine, the DC-10 airplane with JT9D engines, and the DC-9 airplane with refanned JT8D engines. It is shown that the new method agrees better with the data base than a recently proposed SAE method. A.R.H.

N79-24771*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
PROGRAM IN ACOUSTICS Final Report
31 May 1979 18 p refs
(Grant NGR-09-010-064)
(NASA-CR-158660) Avail: NTIS HC A02/MF A01 CSCL 20A

Relevant research projects conducted by faculty and graduate students in the general area of aeroacoustics to further the understanding of noise generation by aircraft and to aid in the development of practical methods for noise suppression are listed. Special activities summarized relate to the nonlinear acoustic wave theory and its application to several cases including that of the acoustic source located at the throat of a near-sonic duct, a computer program developed to compute the nonlinear wave theory, and a parabolic approximation for propagation of sounding in moving stratified media. A.R.H.

N79-24772# Aeronautical Research Labs., Melbourne (Australia).
ACOUSTIC EMISSION SPECTRAL CALIBRATION AND ANALYSIS
C. M. Scala and I. G. Scott Jun. 1978 16 p refs
(ARL-Mat-Note-125; AR-001-284) Avail: NTIS HC A02/MF A01

An acoustic emission (AE) calibration system based on the use of a helium jet is described. Reasons for the choice of the helium jet are given. Various other simulated sources of AE are discussed in terms of their suitability for calibration of AE systems. A.R.H.

N79-24773*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATISTICAL COMPARISONS OF AIRCRAFT FLYOVER NOISE ADJUSTMENT PROCEDURES FOR DIFFERENT WEATHER CONDITIONS
Arnold W. Mueller and David A. Hilton May 1979 35 p refs
(NASA-TP-1430; L-12626) Avail: NTIS HC A03/MF A01 CSCL 20A

Aircraft flyover noise spectra and effective perceived noise level (EPNL) values obtained under widely different weather conditions were adjusted according to a proposed national standard. The results were statistically compared with the same measured spectra adjusted according to an alternate procedure and with reference spectra and EPNL values obtained under almost ideal weather conditions. Three different ways to represent the weather condition through which the sound propagated were also evaluated. J.M.S.

N79-24774# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES. VOLUME 2: TECHNICAL AND OPERATIONAL PARTS 1 AND 2 Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier and W. R. Smith Dec. 1978 127 p refs
(Contract DAAB07-75-C-0044)
(AD-A065566; FR-79-12-40-Vol-2; DELET-TR-75-0044-F-V-2)
Avail: NTIS HC A07/MF A01 CSCL 09/5

The object of the program was the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract, and to establish a base and plans which may be used to meet expanded requirements. The primary requirement was

the pilot line production of devices that are reliable, reproducible, and low cost. The first phase of this program required the design, fabrication and testing of a total of 60 prototype bandpass, tapped delay line and pulse compression SAW filters on both lithium niobate and ST-quartz. Deviations form the insertion loss specification occurred with the BP-LN and TDL-100 designs. In the former case, a redesign excluding the program-specified multi-strip coupler, was theoretically evaluated. In the latter case, as pointed out in the Hughes proposal, a theoretical analysis precluded the possibility of a specification accommodation. It was necessary to revise the specification for both designs since the customer insisted on utilization of the multistrip coupler in the BP-LN. GRA

N79-24775# Catholic Univ. of America, Washington, D. C.
A FORTRAN CODE FOR THE CALCULATION OF SOUND PROPAGATION IN A RANGE DEPENDENT OCEAN 2. RANGE FUNCTIONS AND MODE COUPLING Final Technical Report, 15 Oct. 1976 - 15 Jan. 1977
F. S. Chwieroth 14 Jun. 1978 57 p refs
(Contract N00173-77-C-0008; Proj. SF52-552)
(AD-A062916) Avail: NTIS HC A04/MF A01 CSCL 09/2

Pierce's adiabatic normal-mode theory of sound propagation in a range dependent ocean duct is extended to the case of sound channels with less than gradual range dependence. A computational method is devised to solve the ensuing coupled range equations by diagonalization. This is applied to a channel with arbitrary (numerically given) range dependence, by dividing it into range segments with constant properties each. The local depth functions are taken as the Airy function solutions in a piece-wise linearized stratified medium with arbitrary sound velocity profile. The method is applied to some simple as well as to realistic cases of range dependent sound channels, and the dependence of the mode coupling effects on the degree of range dependence is determined. Author

N79-24776# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
ANALYSIS OF ACOUSTICAL EFFECTS OF RECEIVER AND SOURCE MOTIONS AT SHORT RANGES IN THE DEEP OCEAN
M. J. Jacobson, W. L. Siegmann, and J. L. Kays 1 Mar. 1979 57 p refs
(Contract N00014-76-C-0288)
(AD-A066199; RPI-MATH-124) Avail: NTIS HC A04/MF A01 CSCL 08/10

An analytical approach is used to determine general results for the effects of both receiver and source motions on a CW signal transmitted through a deep ocean channel at short ranges. A bilinear sound-speed profile is used. The receiver and source are restricted to the surface, and only SRBR rays are relevant. Time-dependent expressions for the total-field amplitude and phase are developed for appropriately limited time intervals, and numerical results are presented. General analytical expressions for the total field are derived and demonstrated to approximate closely numerical results. These expressions provide the basis for a study of the acoustical effects of varying motion parameters and initial range. It is demonstrated that effects of differences in range on total-field phase rate and the time interval between amplitude maxima are significant at short ranges and diminish as range increases. Effects on total field due to receiver motion are shown to be both significant and widely varying, depending on receiver and source directions and speeds. Author (GRA)

N79-24777# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
INTERNAL AND EXTERNAL MODELS OF VARIABLE PARAMETER FILTERS [RAPPORT STAGE D. E. A. - MODELES INTERNES ET MODELES EXTERNES DE FILTRES ALEATOIRES A PARAMETERES VARIABLES]
H. Fontaine 29 Sep. 1977 49 p refs In FRENCH
(CEPHAG-44/77) Avail: NTIS HC A03/MF A01

Wave propagation through a random fluctuating medium is discussed, particularly underwater acoustic propagation. A partial derivative, complex coefficients equation describes the general internal model of a random filter with variable parameters. After discussing external medium properties internal representations are studied in correspondance with mediums WSS (Wide Sense Stationary), UD (Uncorrelated Diffusion), and WSSUD. Since an equivalent internal model is relatively simple, an optimal receiver could be developed from it. Author (ESA)

N79-24778# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
OPTIMAL DETECTION IN THE PRESENCE OF REVERBERATION: STUDY AND DISCUSSION OF THE STATIONARY CASE [DETECTION OPTIMALE EN PRESENCE DE REVERBERATION ETUDE ET DISCUSSION DU CAS STATIONNAIRE]
G. Jourdain and G. Loubet 26 Oct. 1977 34 p refs In FRENCH
(CEPHAG-48/77) Avail: NTIS HC A03/MF A01

The detection problem of a known signal mixed with reverberation noise is discussed under the hypothesis of the reverberation being locally stationary for the duration of the signal. The performances obtained with an optimal or conventional receiver (adaptive filter) were compared using signals from conventional underwater systems. For stationary cases, such as those of pulse signals or monochromatic signals, the performance gain of an optimal receiver is negligible. Results coincide with the theoretical conclusions. Author (ESA)

N79-24779# Forschungsinstitut fuer Hochfrequenzphysik Werthhoven (West Germany).
DETECTION OF LOW FLYING AIRCRAFT BY ACOUSTICAL MEANS
J. Schiller Jul. 1978 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-8-78) Avail: NTIS HC A04/MF A01

Detection and location of very low flying aircraft is often impossible or at least very difficult to achieve by radar. The idea of filling this detection gap by making use of the acoustic noise radiated from an aircraft is considered. Some general thought is given to the problem of acoustically measuring parameters of targets that move with speeds close to sonic speed. Some preliminary experiments allow a rough estimate of the detection range and bearing measurement errors to be made. Author (ESA)

N79-24780# National Technical Information Service, Springfield Va.
AIRCRAFT SONIC BOOM: STUDIES ON AIRCRAFT FLIGHT, AIRCRAFT DESIGN, AND MEASUREMENT. BIBLIOGRAPHY WITH ABSTRACTS Progress Report 1964 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 197 p Superseds NTIS/PS-78/0238; NTIS/PS-77/-0218; NTIS/PS-76/0175 (NTIS/PS-79/0264/6; NTIS/PS-78/0238; NTIS/PS-77/0218; NTIS/PS-76/0175) Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

The reports discuss aerodynamic design of aircraft and wings, flight characteristics and maneuvers, supersonic transport characteristics, acoustic fields and noise measurement, government policies and regulations, meteorological parameters, shock waves, and supersonic and hypersonic wind tunnel tests, along with other theoretical and general investigations. This update bibliography contains 188 abstracts, 7 of which are new entries to the previous edition. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-24781 Texas Univ. at Dallas, Richardson.
MULTIPHOTON SPECTROSCOPY OF Cs-INERT GAS Ph.D. Thesis
Mohammad Ali Chellehmalzadeh 1978 206 p
Avail: Univ. Microfilms Order No. 7909388

Spectroscopic studies of multiphoton absorption in Cs-inert gas excimers were conducted over the 4300-7000 A wavelength region with a tunable dye laser source having a linewidth better than 0.1 nm. The dye laser was pumped with a nitrogen laser

of high peak power constructed in the laboratory. At 8KV charging voltage it produced 4.5 mJ pulses. In situ detection of the ionization resulting from multiphoton excitation through resonant excimer states was accomplished through the inclusion of a space charge limited diode in the absorption cell. As a result, spectra were obtained which had comparable signal to noise ratios and two orders of magnitude better resolution with one order of magnitude less krypton and two orders of magnitude less cesium vapor than used to obtain the best excimer spectra made with conventional methods. Dissert. Abstr.

N79-24782 Connecticut Univ., Storrs.
OPTICAL POLARIZATION MEASUREMENTS AND EXCITATION MECHANISMS IN LOW ENERGY ION-ATOM COLLISIONS Ph.D. Thesis
David Allison Clark 1978 238 p
Avail: Univ. Microfilms Order No. 7911349

Intensity measurements of the visible radiation resulting from impact excitation of helium atoms by helium ions are made by photon counting, with polarization analysis, over the energy range of 65eV to 1keV in an ion beam experiment. Radiation from the decay of helium n=3 and n=4 excited states is observed. Total excitation cross sections are derived from the observed data. Particular attention is given to the development of a formulation which allows an accurate correction for factors such as cascade population of the excited state, branching and neutralization by charge exchange of the incident ions. Observations of the radiation are made at incident ion energies which are very closely spaced so that any oscillations in the cross sections are apparent when the cross sections are plotted as a function of incident ion energy. Dissert. Abstr.

N79-24783 South Carolina Univ., Columbia.
THE MEASUREMENT OF ABSOLUTE PAIR PRODUCTION CROSS-SECTIONS AT NEAR-THRESHOLD ENERGIES AND THE DEVELOPMENT OF A HIGH RESOLUTION POSITION SPECTROMETER Ph.D. Thesis
Thomas A. Girard 1978 148 p
Avail: Univ. Microfilms Order No. 7911831

The measurements are in agreement with Overbo and Tsengand Pratt theories, of the pair production but diverge from the predictions of Tseng and Pratt in the case of Z=13, and for low incident photon energy and large Z. Directions for the continued investigation of pair production processes are considered. The development of a new, high resolution spectrometer for use in on-line precision mass measurements for nuclei far from stability is reported. The spectrometer yields accurate end-point energies, although the distribution intensities are distorted. The continued investigation of the spectrometer performance, with respect to evaluation of the response function of the intrinsic hyperpure germanium detector employed, is discussed. Dissert. Abstr.

N79-24784 Texas A&M Univ., College Station.
STUDY OF LOW ENERGY CHARGE TRANSFER COLLISIONS USING A RADIO FREQUENCY QUADRUPOLE ION TRAP Ph.D. Thesis
Clinton Hayes Holder, Jr. 1978 181 p
Avail: Univ. Microfilms Order No. 7909201

The spin independent total charge transfer cross section for helium ions interacting with cesium atoms was measured for an energy range between 0.1 and 1.0 electron volt. The experiment was performed in a radio-frequency quadrupole ion trap used to store helium ions which collided with an atomic beam of cesium atoms. In addition, the process of He-4(+) and H2(+) ion creation by electron beam bombardment, the temporal behavior of the ion cloud after ion creation, ion-ion and ion-atom interactions, and the reaction of H3(+) in the trap were studied. It was shown that for a saturated trap ion-ion collisions constitute the major loss process and limit the maximum number of ions stored. Dissert. Abstr.

N79-24785 California Univ., Riverside.
DIFFERENTIAL CROSS SECTION MEASUREMENTS FOR ELECTRON IMPACT ON BARIUM IN GROUND AND LASER EXCITED STATES Ph.D. Thesis
Stephen Wayne Jensen 1978 253 p
Avail: Univ. Microfilms Order No. 7911739

A crossed electron-atom-laser beam geometry was employed and a new electron impact spectrometer was developed. Differential cross section (DCS) measurements for electron scattering by the ground 6s2s1 level of barium included elastic and inelastic processes. All of the DCS were extremely forward peaked with the P1 DCS often exceeding the elastic DCS for scattering angles less than 10 deg. The excited 6s6p P1 level of barium was optically pumped utilizing a tunable, single frequency dye laser. Electron scattering from this polarized atomic beam provided information on the scattering amplitudes and their relative phase. Measurements of alpha and chi were made for superelastic electron scattering corresponding to the transition throughout the angular range from -15 deg to 15 deg at 30 eV electron impact energy. Dissert. Abstr.

N79-24786 Texas Univ. at Dallas, Richardson.
RELAXATION OF EXCITED NEON ATOMS IN THEIR PARENT GAS Ph.D. Thesis
Rafael Armando Sierra 1978 132 p
Avail: Univ. Microfilms Order No. 7909390

Time resolved decay profiles of the excited state densities were analyzed and a multitude of collisional and radiative processes identified. These included both two and three-body collisions with neutrals, two body collisions with electrons and decay of trapped radiation. At pressures above 100 torr the decay of the triplet states was controlled by collisions with background ground state atoms. This contrasts strongly with the low pressure case where collisions with electrons were found to be important at early times. Rate equations for the various processes were solved and rate constants determined. Dissert. Abstr.

N79-24787 California Inst. of Tech., Pasadena.
INTERACTION POTENTIALS OF ATOM-MOLECULE AND MOLECULE-MOLECULE SYSTEMS FROM CROSSED BEAM EXPERIMENTS Ph.D. Thesis
John Thomas Slankas 1979 57 p
Avail: Univ. Microfilms Order No. 7911635

The theory of intermolecular potentials and of elastic scattering are surveyed to provide the basis for interpreting the results obtained. Essentially three independent experiments were performed on the H2(D2)+Ar system to check internal consistency. The results obtained were also consistent with other laboratories, some using different techniques. The effects of the non-spherical part of the intermolecular potential were found to be negligible, within error of the experiment. A potential model with five independent parameters, was found to provide the best representation of the intermolecular potential. Central-field SPFD potentials were found to provide satisfactory descriptions of the intermolecular potential for He + CH4, NH3, H2O, SF6 systems. Results of studies on the H2(D2) + NH3, H2O systems are included. Dissert. Abstr.

N79-24788 Kent State Univ., Ohio.
DIVERGENCE OF THE BEND CURVATURE COEFFICIENT ABOVE THE NEMATIC-SMECTIC A PHASE TRANSITION: FREEDERICKSZ TRANSITION Ph.D. Thesis
Douglas Jack Brisbin 1978 215 p
Avail: Univ. Microfilms Order No. 7909963

A magnetic induced bend deformation (the Freedericksz transition) was used to the bend curvature coefficient as a function of temperature above a second order nematic-smectic A (NA) phase transition in liquid crystal 4-n-pentylphenylthiol-4'-n-octyloxybenzoate (8S5). It was found that the bend curvature coefficient diverged with an exponent of .67 plus or minus .02. From a light scattering measurement of the twist mode the NA transition temperature was determined. It was found that the NA transition temperature determined from light scattering agreed, within error bars, with the Freedericksz result. The need for correction to scaling terms in the Freedericksz fitting equations is discussed. A magnetic field induced shift in the NA transition temperature was also observed and was found to be sample thickness dependent. Dissert. Abstr.

N79-24789 North Texas State Univ., Denton.
ECKART FRAME MOTIONS AND MOLECULAR VIBRATIONS Ph.D. Thesis
Frederick Otto Meyer, III 1978 90 p

Avail: Univ. Microfilms Order No. 7911079

The angular motion and the angular acceleration of the Eckart frame were investigated. Computer calculations were included for vibrational modes of AB sub N molecules. Eckart frame inversions were also found in the calculations. A technique for taking the first and second differentials of real symmetric eigenvalue problems was developed. This technique was applied to the first differential of the Eckart frame matrix. An expression was found for a molecule near equilibrium. The torque on a molecule is related to the second derivative of the Eckart vector matrix. A method of calculating the angular acceleration of the frame is discussed. The kinetic energy is presented leading to a discussion of normal coordinate accuracy. The Jacobian of the transformation from laboratory coordinates to Eckart frame normal coordinates was reviewed. Dissert. Abstr.

N79-24790 Rutgers - The State Univ., New Brunswick, N. J.
COUPLING OF ELECTRONIC AND VIBRATIONAL MOTIONS IN MOLECULES Ph.D. Thesis
Ilker Ozkan 1978 176 p
Avail: Univ. Microfilms Order No. 7910419

A theory is presented, which handles the coupling of vibrational and electronic motions in nondegenerating and (nearly) degenerate electronic states on an equal footing. A derivation of the Born-Oppenheimer (BO) approximation is given. The vibronic Schrodinger equation is formulated in a fixed electronic basis, leading to an infinite set of coupled equations. These equations are solved by iteration using the well-known multidimensional partitioning techniques. The method and the physical ideas are extensively illustrated by means of a two-state, two-mode vibronic coupling model. Dissert. Abstr.

N79-24791*# Missouri Univ. -Rolla. Dept. of Mechanical and Aerospace Engineering.
CONTINUUM ABSORPTION COEFFICIENT OF ATOMS AND IONS Final Report
B. F. Armaly May 1979 40 p refs
(Grant NsG-1581)
(NASA-CR-158536) Avail: NTIS HC A03/MF A01 CSCL 20H

The rate of heat transfer to the heat shield of a Jupiter probe has been estimated to be one order of magnitude higher than any previously experienced in an outer space exploration program. More than one-third of this heat load is due to an emission of continuum radiation from atoms and ions. The existing computer code for calculating the continuum contribution to the total load utilizes a modified version of Biberman's approximate method. The continuum radiation absorption cross sections of a C - H - O - N ablation system were examined in detail. The present computer code was evaluated and updated by being compared with available exact and approximate calculations and correlations of experimental data. A detailed calculation procedure, which can be applied to other atomic species, is presented. The approximate correlations can be made to agree with the available exact and experimental data. L.S.

N79-24792*# Maryland Univ., College Park.
TIME-OF-FLIGHT TECHNIQUE FOR PARTICLE IDENTIFICATION AT ENERGIES FROM 2 TO 400 keV/NUCLEON
G. Gloeckler and K. C. Hsieh (Tucson Univ., Ariz.) [1979] 28 p refs
(Grants NGR-21-002-224; NGR-21-002-316; NGR-03-002-107)
(NASA-CR-158611) Avail: NTIS HC A03/MF A01 CSCL 20H

The time of flight technique for particle identification was extended to 2 keV/nucleon and the size of the start-time detector was reduced considerably by the use of carbon foils of few micrograms/cm square in thickness combined with microchannel plates for detecting secondary electrons. Time of flight telescopes incorporating this start-time device were used to measure the stopping power of a number of low energy heavy ions in thin carbon foils and the charge states of these ions emerging from such foils. Applications for the detection and identification of low energy interplanetary and magnetospheric particles are suggested. M.M.M.

N79-24793# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Physics.
MULTI-REGGE FACTORIZATION IN INCLUSIVE TWO-PARTICLE PRODUCTION
Michael J. Puhala May 1979 109 p refs
(Grant NSF PHY-77-25279)
(ILL-(TH)-79-14) Avail: NTIS HC A06/MF A01

The multi-Regge expansion for the eight-particle amplitude with one triple-Regge and two double-Regge couplings is considered. It is shown that under trivial conditions and with a suitable choice of helicity contours, the double-Regge couplings in the multi-Regge (MR) limit are identical, to leading order, with couplings obtained in the mixed helicity-pole Regge-pole (HPRP) limit appropriate to inclusive reactions. An intuitive picture of how helicity poles may be visualized at the triple-Regge vertex is presented as an argument for the identity of the MR and HPRP limit. Assuming the mentioned identity, the diffractive contribution (neg pi)p yields (neutral rho)(neg pi)x is calculated and the problem of isolating this mechanism experimentally is discussed. Experimental tests for the identity of the couplings are proposed. A.R.H.

N79-24794# California Univ., Berkeley. Dept. of Chemistry.
STRUCTURAL AND DYNAMIC CONSIDERATIONS IN MOLECULAR COLLISION THEORY Final Report, 1 May - 31 Aug. 1978
C. Bradley Moore and R. D. Levine 31 Aug. 1978 77 p refs
Prepared in cooperation with Hebrew Univ., Jerusalem
(Contract N00014-78-C-0449)
(AD-A065531) Avail: NTIS HC A05/MF A01 CSCL 07/4

Work under this Contract has been initiated in several directions. In one major and one minor project there has been sufficient progress to warrant publication. These are discussed below and detailed accounts are enclosed. Two additional projects which appear promising require additional work and are only mentioned here (under (3) below) as a preliminary account. (1) A theoretical framework for the interpretation of structural effects in reactive molecular collisions has been formulated; (2) An exact information theoretic solution to the problem of a collinear collision of an atom with a Morse type (i.e. anharmonic) oscillator has been provided; and (3) Preliminary work has been carried out on the question of the exact definition of a 'prior' expectation for the overall magnitude of the rate constant. Such a definition is particularly relevant to eletronic excitation processes because of the large differences in the available energy that can occur between the different reaction products. GRA

N79-24795# New York Univ., N. Y. Dept. of Chemistry.
DIFFUSION LIMIT FOR THE TRANSPORT OF QUASIFREE ELECTRONS IN LIQUIDS
P. J. PaesLeme 20 Feb. 1979 12 p refs
(Contract N00014-75-C-0397; NR Proj. 051-258)
(AD-A065679; TR-6) Avail: NTIS HC A07/MF A01 CSCL 20/8

A model of photoelectron emission by liquids is treated in terms of a transport problem. Its asymptotic behavior is studied in the limit when the mean free path becomes small and the geminetric recombination is neglected. This solution is then shown to be in agreement with that previously assumed in the Nemec theory. Author (GRA)

N79-24796# Indiana Univ. at Bloomington. Dept. of Chemistry.
A THEORETICAL STUDY INTO THE SPATIAL DISTRIBUTION OF ATOMS SURROUNDING AN INDIVIDUAL SOLUTE PARTICLE VAPORIZING IN AN ANALYTICAL FLAME Interim Report
Charles B. Boss and Gary M. Hieftje Feb. 1979 33 p refs
(Contract N00014-76-C-0838)
(AD-A066182; TR-21; Rept-16) Avail: NTIS HC A03/MF A01 CSCL 21/2

A theoretical model is developed to describe the synergic effects of analyte vaporization and diffusion rates on the spatial distribution of analyte atoms in the vapor cloud surrounding an individual solute particle in a laminar flame or plasma. A mathematical convolution of the vaporization and diffusion processes is used to describe the analyte spatial distribution. Unfortunately, the resulting convolution integral cannot be solved

in closed form for the experimentally observed vaporization function, and several simplifying approximations to the vaporization function are compared and shown to be useful. With this new model, the analytical consequences of changes in both diffusion coefficient and vaporization rate are examined, and the resulting changes in spatial distribution of atoms about a typical analyte particle are compared. Author (GRA)

N79-24797# Indiana Univ. at Bloomington. Dept. of Chemistry.

MEASUREMENT AND COMPARISON OF RELATIVE FREE-ATOM FRACTIONS IN THE HELIUM-OXYGEN-ACETYLENE AND AIR-ACETYLENE FLAMES Interim Report

K. A. Saturday and G. M. Hieftje 1 Mar. 1979 51 p refs
(Contract N00014-76-C-0838)
(AD-A066153; TR-22) Avail: NTIS HC A04/MF A01 CSCL 07/4

The free atom fractions for six elements in the helium-oxygen-acetylene and air-acetylene flames were measured and show the helium-diluted flame to be intermediate in atom formation capabilities between the air-acetylene and nitrous oxide-acetylene flames. Author (GRA)

N79-24798# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

COLLISION INDUCED DISSOCIATION OF DIATOMIC MOLECULES Ph.D. Thesis

William F. Bailey Jun. 1978 283 p refs
(AF Proj. 2301)
(AD-A066191; AFIT/DS/PH/78-2) Avail: NTIS HC A13/MF A01 CSCL 07/4

A discrete collisional theory of dissociation under equilibrium and nonequilibrium conditions using a quantum kinetic approach to molecular energy transfer was investigated. The kinetic equations for molecular dissociation in a pure diatomic gas and diatomic gases in the presence of an inert diluent were formulated and solved. The incubation time was calculated and exhibited good agreement with experimental measurements. An analytic steady state form for the vibrational population and dissociation rate was developed which agreed with the time-dependent calculations. It was determined that rotational states play a significant role in the dissociation process and that the standard ladder model is inadequate. When rotational effects are properly included in the analysis, good agreement with experimental data is obtained. The kinetics developed to address thermal dissociation under equilibrium conditions were extended to treat the highly nonequilibrium conditions achieved through intense optical pumping or electron impact excitation. The nonequilibrium treatment included a detailed investigation of electron impact dissociation. A parametric study of heavy particle and electron impact dissociation rates revealed that under conditions typically encountered in electric discharges, electron impact dissociation dominates the heavy particle rate. Author (GRA)

N79-24799# Battelle Columbus Labs., Ohio.

HEAT SOURCE COMPONENT DEVELOPMENT PROGRAM Report, Jul. - Dec. 1978

E. L. Foster, Jr., comp. Jan. 1979 95 p refs
(Contract W-7405-eng-92-094)
(BMI-X-699; Rept-7) Avail: NTIS HC A05/MF A01

Components for advanced radioisotope heat sources to be used in advanced static and dynamic power conversion systems are discussed. The operational and reentry response of selected heat source trial designs, and their thermal response to a space shuttle solid propellant fire environment were assessed. Thermal, ablation, and thermal stress analyses were conducted using two-dimensional modeling techniques previously employed for the analysis of the earlier trial design versions, and modified in part to improve the modeling accuracy. Further modifications were made to improve the modeling accuracy. Thermal, ablation, and thermal stress analyses were then conducted for the trial design selected for more detailed studies using three dimensional modeling techniques. DOE

N79-24800# Arizona Univ., Tucson.

CALCULATIONS ON ISOTOPE SEPARATION BY LASER INDUCED PHOTODISSOCIATION OF POLYATOMIC MOLECULES Final Report

W. E. Lamb, Jr. Nov. 1978 25 p
(Contract EN-77-S-02-0294)
(COO-4294-2) Avail: NTIS HC A02/MF A01

The theory of isotope separation produced by the illumination of polyatomic molecules by intense infrared laser radiation was investigated. Newton's equations of motion were integrated for the atoms of ths SF6 molecule including the laser field interaction interatomic potential valid for arbitrary configurations of the seven particles was obtained. This potential gives the correct symmetry of the molecule, the equilibrium configuration, the frequencies of the six distinct normal modes of oscillation, and the correct (orassumed)value of the total potential energy of the molecule. Other conditions can easily be imposed in order to obtain a more refined potential energy function, for example, by making allowance for anharmonicity data. A suitable expression was also obtained for the interaction energy between a laser field and the polyatomic molecule. The electromagnetic field is treated classically, and it would be easily possible to treat the cases of time dependent pulses, frequency modulation, and noise. DOE

N79-24801# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, Dec. 1978

R. D. Baker Dec. 1978 48 p refs
(Contract W-7405-eng-36)
(LA-7694-PR) Avail: NTIS HC A03/MF A01

Studies related to the use of (Pu-238)O2 in radioisotopic power systems are described. The three programs involved are general-purpose heat source development, space nuclear safety, and radioisotopic terrestrial safety. DOE

N79-24802# Montpellier Univ. (France). Dept. of Physique Mathematique.

UNITARITY CONSTRAINTS ON MESON-NUCLEON HELICITY-FLIP AMPLITUDES AND SLOPE OF THE DIFFRACTION PEAK

G. Mennessier, S. M. Roy (Tata Inst. of Fundamental Res.), and Virendra Singh (Tata Inst. of Fundamental Res.) Jun. 1978 22 p refs
(PM/78/7) Avail: NTIS HC A02/MF A01

The MacDowell-Martin constraint on the slope parameter bexpA for spinless cases is generalized to include spinless-one half spin elastic scattering with conservation of parity. Optimal answers for all energy values are given as well as a simpler slightly weaker constraint. Unitarity restrictions were also obtained on the helicity flip amplitude in terms of sigma sub tot, sigma sub el, and bexpA(s). Author (ESA)

N79-24803# Montpellier Univ. (France). Dept. of Physique Mathematique.

WEAK INTERACTION EFFECTS IN ELECTRON POSITRON YIELDS 2 PHOTONS

M. Capdequi-Peyranere, G. Grunberg, F. M. Renard, and M. Talon Jun. 1978 27 p refs
(PM/78/8) Avail: NTIS HC A03/MF A01

High energy quantum electrodynamic (QED) tests were made to study high order weak interaction effects since for this reaction there is no second order Z exchange. Kinematic quantities (cross sections and polarizations for doing these tests) are defined in the most general way in order to account for any unexpected effect. The calculations of the 4th order weak terms are done in the framework of SU(2) x U(1) gage theory; corrections to QED appear to be less than one per thousand in the range of future colliding beams. Author (ESA)

N79-24804# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Abt. Atom-und Molekuelphysik.

MEASUREMENTS OF THE DIFFERENTIAL SCATTERING CROSS SECTIONS OF ELECTRON EXCITED Na ON Hg Ph.D. Thesis - Goettingen Univ., West Ger. [MESSUNGEN DIFFERENTIELLER STREUQUERSCHNITTE VON ELEKTRONISCH ANGEREGTEM Na AND Hg]

Hans-Otto Hoppe Dec. 1977 89 p refs In GERMAN
(MPIS-13/1977) Avail: NTIS HC A05/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 16.20

Crossed molecular beam techniques were used to measure the differential scattering cross sections of electron excited Na atoms on Hg atoms. Some Na atoms were excited up to the 3 2P3/2 F = 3 hyperfine state at the beam crossing position by a narrow band continuous wave laser. The difference between the scattering intensities with and without the laser beam yields the total differential scattering cross section Na 3P3/2 Hg. Mean values obtained in the 3 to 78 deg range (laboratory system) are given and compared with ground state Na(3S1/2) Hg scattering. An oscillatory energy dependent structure was measured at large angles greater than 30 deg. Quantum mechanics calculations can thus be performed from the mutual interaction NaP-states with Hg pseudopotential. Author (ESA)

N79-24805# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ON THA REACTION BETWEEN O-H-D-B-r-Cl ATOMS WITH VIBRATIONALLY EXCITED HCl [UEBER DIE REAKTIONEN VON O-H-D-Br UND Cl ATOMEN MIT SCHWINGUNGSANGEREGTEM HCl]
Michael Kneba Nov. 1977 129 p refs In GERMAN (MPIS-19/1977) Avail: NTIS HC A07/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 21.75

The reaction was investigated in the gaseous phase using a thermostatic flow distribution (to produce free atoms) in conjunction with an HCl laser (to selectively generate excited vibrational levels in the HCl). Laser induced resonance fluorescence was used to measure temporal level concentrations HCl (v=1, v=2). The evolution of the atomic reactions occurring was monitored by atomic line resonance absorption measurements. A beam extraction system coupled to a mass spectrometer enabled specific isotopes to be identified. The various reactions taking place are given together with the corresponding reaction speed constants. Author (ESA)

N79-24945# Joint Publications Research Service, Arlington, Va.
CHANNELING OF CHARGED PARTICLES
A. F. Tulinov and N. G. Chechenin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 42-58 refs Transl. into ENGLISH from Priroda (Moscow), no. 2, Feb. 1979 p 2-12 (For primary document see N79-24941 15-99)
Copyright. Avail: NTIS HC A04/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-24806 Colorado Univ. at Boulder.
FIELD THEORIES WITH MULTIPLE FERMIONIC EXCITATIONS Ph.D. Thesis
James Patrick Crawford 1978 142 p
Avail: Univ. Microfilms Order No. 7911436

The reason for the existence of the muon was an enigma since its discovery. It is proposed that the proliferation of leptons and quarks is comprehensible if there are only four fundamental particles, the leptons v sub e and e(-), and the quarks u and d. It is imagined that all other leptons and quarks are excited states of these four fundamental entities. Attention is restricted to the charged leptons and the electromagnetic interactions only. A detailed study of a field theory in which there is only one fundamental charged fermionic field having two (or more) ec excitations is embarked upon. It is shown that under certain conditions this theory reproduces the S matrix obtained from usual QED. A lepton charge operator is defined and a superselection rule for this lepton is found. Dissert. Abstr.

N79-24807 Vanderbilt Univ., Nashville, Tenn.
CHARGED MULTIPLICITY DISTRIBUTIONS AND NEUTRAL STRANGE PARTICLE PRODUCTION IN ANTIPROTON-DEUTERON AND NEGATIVE PION-DEUTERON INTERACTIONS AT 100 GeV/c Ph.D. Thesis
Howard Cobb Fenker 1978 109 p
Avail: Univ. Microfilms Order No. 7909273

Using a tagged beam of antiprotons and negative pions at laboratory momentum of 100 GeV/c, the gross features of the collisions of these particles with deuterium nuclei were investigated. Beam track identification and flux calculations were performed in such a way that the Glauber screening formula for inelastic collisions can be tested. The spectator model of deuterium interactions is employed in the derivation of neutron target and proton target multiplicity distributions. A simple model allowing the production of either zero or one pair of charged particles in rescattering events is shown to provide a satisfactory description of the data, and is used in the determination of the final topological cross sections. Available pn cross sections are used in conjunction with the anti-pn cross sections to study anti-pn annihilation. The moments derived from the multiplicity distributions are discussed. Neutral strange particles are studied through their V-zero decay modes. Dissert. Abstr.

N79-24808 Cornell Univ., Ithaca, N. Y.
THEORY OF FOIL-LESS DIODES Ph.D. Thesis
James Chen 1979 167 p
Avail: Univ. Microfilms Order No. 7910801

A self-consistent theory for the generation of relativistic electron beams in foil-less diodes is developed. Steady-state situations are considered where the electron motion is collisionless. Two-dimensional rectangular and cylindrical geometries are considered with relativistic diode potentials. A strong applied magnetic field is assumed to exist parallel to the axis of the diode. A useful measure of the diode potentials is found. The problem of finding the self-consistent space-charge-limited flow of electrons is reduced to a singular linear integral equation. For the cylindrical geometry, a formalism is developed for numerical solution of the integral equation. Dissert. Abstr.

N79-24809 Pennsylvania Univ., Philadelphia.
A THEORY OF ANHARMONIC EFFECTS IN VIBRATIONAL NUCLEI Ph.D. Thesis
Ching-teh Li 1978 155 p
Avail: Univ. Microfilms Order No. 7908767

A nonlinear extension of the quasi-particle random phase approximation was developed to calculate the anharmonic effects of vibrational motion in even spherical nuclei. Based on equations of motion, the method uses the algebra of pair operators and the Keiman-Klein method of spectral decomposition. This theory of anharmonic nuclear vibrational motion (NLEM method) is applied to Ni-60, -62, -64, which exhibit one and two phonon quadrupole collective states. The adequacy of the present NLEM method is first established by comparing results obtained with those of an exact diagonalization. To bring the model Hamiltonian into accord with experiment, a simple empirical refinement of the Hamiltonian is also carried out within the framework of the NLEM method. In practice, it is found that a simple additional parameter in the Hamiltonian suffices to yield descriptions of the quadrupole states in Ni isotopes comparable in precision to the most up-to-date versions (modified, adjusted, etc.) of the surface delta interaction model. Dissert. Abstr.

N79-24810 Texas Univ. at Austin.
PROTON AND PION ELASTIC SCATTERING FROM NUCLEI AS A PROBE OF NUCLEON-NUCLEON CORRELATIONS Ph.D. Thesis
James Francis Lynch 1978 99 p
Avail: Univ. Microfilms Order No. 7910989

The effects of various two-nucleon correlations (Pauli, dynamical, and center-of-mass) upon medium energy proton-nucleus and low energy pion-nucleus elastic scattering are determined. For the proton scattering case, modifications of Feshbach's coupled channel formalism are employed to describe p-He-4 scattering at 1050 MeV; p-C-12 scattering at 800 MeV; and p-Pb-208 scattering at 800 MeV. It is found that for p-He-4 scattering, the center-of-mass correlation is by far the dominant correlation and that the average inelastic channel excitation energy, contrary to previous analyses, should be set to zero. For p-C-12 scattering, the Pauli correlation dominates the center of mass correlation, which although it decreases with increasing target mass number, is still appreciably large. Dissert. Abstr.

N79-24811 Colorado Univ. at Boulder.
A CONFIGURATION SPACE STUDY OF LOW ENERGY PION-NUCLEUS SCATTERING Ph.D. Thesis
Alvin Stephan Rosenthal 1978 172 p
Avail: Univ. Microfilms Order No. 7911468

A coordinate space, pion-nucleus optical potential was constructed from first-order multiple scattering theory. The potential possesses a kinematic correction which transforms the relevant amplitudes from the pi-nucleon to the pi-nucleus center of momentum system, includes effects due to the Pauli principle and involves semi-phenomenological corrections for meson annihilation. The zero-range model was used to describe inelastic cross sections in coupled channels and distorted wave Born approximation. The optical model was also used to derive the double-charge-exchange cross section for O-18(pi(+), pi(-)) Ne-18. The model is applied to the study of pi-meson induced excitation of giant multipole resonances. Dissert. Abstr.

N79-24812 Princeton Univ., N. J.
RADIOACTIVE WASTE DISPOSAL: A COMPARISON OF ALTERNATIVE NUCLEAR FUEL CYCLES Ph.D. Thesis
Hartmut Hans-Ludwig Krugmann 1979 319 p
Avail: Univ. Microfilms Order No. 7910121

The bearing of issues relating to radioactive waste disposal on policy choices between alternative nuclear fuel cycles is examined. Two principal choices are discussed. One is between retaining the current once-through fuel cycle and establishing a more uranium efficient fission economy involving the recycle of plutonium produced by neutron absorption in the nonchain-reacting uranium isotope U-238. The other is between introducing this plutonium economy and embarking on an alternative uranium efficient fission economy which would involve the recycle of the artificial isotope U-233 produced by neutron bombardment of thorium. Dissert. Abstr.

N79-24813 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A DYNAMIC MULTI-CRITERIA ANALYSIS OF SPENT-NUCLEAR-FUEL ALTERNATIVES Ph.D. Thesis
Robert William Langham, II 1978 310 p
Avail: Univ. Microfilms Order No. 7910714

A generalized multiple-objective research and development (R & D) capital budgeting model incorporating production-allocation decisions is developed for the analysis of the spent-nuclear-fuel management problem. The generalized model is decomposed into a multiple-objective R & D capital budgeting problem and a multiple-objective fuel allocation problem. Goal programming is selected as an appropriate modeling technique for both generic models. The spent-nuclear-fuel-allocation problem is further decomposed into a dynamic program with a goal program at each stage. The objectives are to allocate R & D funds to process or technology development and to allocate spent fuel to certain alternatives so as to minimize the weighted and prioritized vector cost. Dissert. Abstr.

N79-24814# Austin Research Associates, Inc., Tex.
INTERACTIONS OF RELATIVISTIC CHARGED PARTICLE BEAMS Final Scientific Report, 1 Jul. 1976 - 30 Sep. 1978
W. E. Drummond, J. R. Thompson, H. V. Wong, G. I. Bourianoff, and B. N. Moore Nov. 1978 305 p refs
(Contract F49620-76-C-0002)
(AD-A066045; ARA-331; I-ARA-78-U-78) Avail: NTIS HC A14/MF A01 CSCL 20/8

Contents: Nonlinear Effects in Quto-resonant Acceleration; Stability of Slab Electron Beam Equilibria; Limiting Currents of an Unneutralized Magnetized Electron Beam in a Cylindrical Drift Tube; Influence of Spatial Variation in Gamma on the Relativistic Electron Beam Cyclotron Mode; Relativistic E-Beam Plasma Heating; Letter Summary of Beam-Plasma Heating Research and Comparison of Results with those of Thode, et al; Self Consistent Equilibria of Unneutralized Relativistic Electron Beams; Linear Theory of Collective Waves Supported by an Unneutralized Relativistic Electron Beam; Linear Theory of Plasma Waves Supported by a Radially Varying Electron Beam in a Magnetized Waveguide; and The Effects of Finite Thermal Spread on the Electron Cyclotron Beam Modes. GRA

N79-24815# Brookhaven National Lab., Upton, N. Y.
MAGNETIZATION EFFECTS IN SUPERCONDUCTING ACCELERATOR MAGNETS
W. B. Sampson, P. F. Dahl, A. D. McInturff, K. E. Robins, and E. J. Bleser 1978 3 p refs
(Contract EY-76-C-02-0016)
(BNL-24939; Conf-780952-29) Avail: NTIS HC A02/MF A01

The effect of the superconductor magnetization on the field shape of dipole magnets was measured. Such effects are most obvious at low fields where the current capability of the windings is very high and only a small fraction is used to support the transport current which produces the field. In most dipoles the fundamental field component is reduced slightly when the field is increasing and enhanced by an almost equal amount when the field is decreasing. The effect on the higher allowed harmonics such as the sextupole and decapole components is much greater, giving rise to considerable hysteretic behavior at the low field levels where the beam is injected into the accelerator. The measurements indicate that it is possible to accurately specify the field from current measurements if a standard energizing cycle is used and the previous history of the magnet is known. DOE

N79-24816# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
STUDIES FOR GEOLOGIC STORAGE OF RADIOACTIVE WASTE IN THE SOUTHEAST
I. Wendall Marine 1978 36 p refs
(Contract EY-76-C-09-0001)
(DP-MS-78-26) Avail: NTIS HC A03/MF A01

The National Waste Terminal Storage program, initiated to conduct the research necessary to select a site for a geologic repository for the storage of high-level, solidified radioactive waste from commercial power reactors, also includes the design and construction of the facility and operation once completed. As part of this program, the Savannah River Laboratory is conducting geological research that is particularly relevant to potential repository sites in states from Maryland to Georgia. The National Waste Terminal Storage program as well as the research program at the Savannah River Laboratory are described. DOE

74 OPTICS

Includes light phenomena.

N79-24817 California Univ., San Diego.
NONLINEAR OPTICAL PROCESSING WITH FABRY-PEROT INTERFEROMETERS Ph.D. Thesis
Bruce John Bartholomew 1979 177 p
Avail: Univ. Microfilms Order No. 7909816

Several nonlinear optical processing operations which may be performed with Fabry-Perot interferometers were explored. In this context nonlinear operations are those where the amplitude of the light in the output plane is a nonlinear function of the input amplitude. The nonlinearity is generated using the multiple beam interference properties of the Fabry-Perot interferometer. Two kinds of optical processors were studied. In one the input image is recorded on some material located between the two mirrors of the interferometer and the laser power and mirror spacing are adjusted to perform the nonlinear operations. The second device, called a saturable resonator, uses a material whose absorption coefficient or index of refraction is a function of intensity. The material is held between the mirrors and the intensity variations of the input projected onto the interferometer produce a spatially varying, nonlinear transmittance function. Dissert. Abstr.

N79-24818 Arizona Univ., Tucson.
CODED IMAGING SYSTEMS USING A FOURIER APERTURE Ph.D. Thesis
Chien Chou 1978 173 p
Avail: Univ. Microfilms Order No. 7909478

A time-varying coded aperture is described which consists of two identical gratings in contact with each other. The two gratings form a difference moire pattern consisting of sine or

cosine variations; in this way an aperture that behaves as an adjustable grating is formed. The aperture measures a single Fourier component of the object distribution at a time and does not require a position-sensitive detector. The effect of a finite detector area is discussed as is the use of a long and narrow detector for eliminating the effect of the sum moire fringes. Two reconstruction algorithms are considered. A noise analysis shows the same signal to noise ratio behavior in the reconstructed images as in a conventional coded-aperture-imaging system. The systematic errors due to the square wave transmission of the gratings, the gap between the gratings and the misalignment of the gratings are analyzed. Dissert. Abstr.

N79-24819 Cornell Univ., Ithaca, N. Y.
A STUDY OF GRATING FILTERS IN THIN-FILM OPTICAL WAVEGUIDES Ph.D. Thesis
Amitabha Basu 1979 259 p
Avail: Univ. Microfilms Order No. 7910733

The use of a periodic corrugation in a thin film optical waveguide as a band-step filter, or equivalently, a band-selective reflector is studied. The effects of various kinds of nonuniformities on the spectral response of a first-order filter are studied where there are only two contradirectional guided modes of the same order, coupled together through interaction with the grating. A method was developed where the nonuniformities in the grating filter parameters are incorporated in the coupled-mode equations which describe the variations in the amplitudes of the two contradirectional modes along the length of the grating structure. The spectral response of second and higher order grating filters were also studied in which the two contradirectional guided modes are also coupled to the radiation modes of the waveguide. The fabrication of second and third order grating filters are described. Dissert. Abstr.

N79-24820 California Inst. of Tech., Pasadena.
NEW OPTICAL WAVEGUIDE DEVICES USING PERIODIC AND CHIRPED SURFACE CORRUGATIONS AND OPTICAL WAVES IN PERIODIC LAYERED STRUCTURES Ph.D. Thesis
Chi-Shain Hong 1979 226 p
Avail: Univ. Microfilms Order No. 7911625

Theoretical and experimental studies of some corrugated waveguide devices for use in optical communications and integrated optics are described. These devices include wavelength demultipliers and broad-band optical filters using chirped corrugations, and optical scanners using the electrooptic effect in the corrugations. The propagation of electromagnetic waves in periodic layered structures is also described. Dissert. Abstr.

N79-24821*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
METHOD OF CALCULATING RETROREFLECTOR-ARRAY TRANSFER FUNCTIONS
David A. Arnold [1978] 166 p refs
(Grant NGR-09-015-196)
(NASA-CR-157932; SAO-Special-Rept-382) Avail: NTIS HC A08/MF A01 CSCL 20F

Techniques and equations used in calculating the transfer functions to relate the observed return laser pulses to the center of mass of the Lageos satellite retroflector array, and for most of the retroreflector-equipped satellites now in orbit are described. The methods derived include the effects of coherent interference, diffraction, polarization, and dihedral-angle offsets. Particular emphasis is given to deriving expressions for the diffraction pattern and active reflecting area of various cube-corner designs. A.R.H.

N79-24822 Centre de Recherches de la Compagine Generale d'Electricite, Marcoussis (France). Sect. Electronique et Optique.
DIVERSION AND MODULATION OF OPTICAL ENERGY IN GRADED INDEX MULTIMODE FIBER OPTICS Action Concertee Physique Electronique. Final Report [ETUDE DE LA DERIVATION ET DE LA MODULATION DE L'ENERGIE OPTIQUE MULTIMODE A EXHELON D'INDICE]
Luc Jeunhomme and Jean-Paul Pocholle 4 Oct. 1977 50 p refs In FRENCH
(Contract DGRST-76-7-0788)
(Rept-77-213/R) Avail: NTIS HC A03/MF A01

Accurate coupling of directed modes and radiating modes in a fiber was induced by applying quasi-sinusoidal deformations at the axis of a multimode fiber. Recovery of the energy carried along these radiating modes through the intermediary of an index field adaptor surrounding the fiber allows for a diversion while maintaining continuity and with very little loss at insertion. A coupling - 10db supplying 42 of the total power in each of the two branches derived and transmitted was obtained. An attempt to induce the conversion of the modes, through the ultrasonic wave, was made. Coupling of the modes results, but is insufficient to permit modulation of amplitude of the wave being transmitted by the fiber. Author (ESA)

N79-24823# Boeing Aerospace Co., Huntsville, Ala.
DEVELOPMENT OF PRECISION OPTICAL PATH ALIGNMENT SYSTEM (POPAS) Final Report, Jan. 1978 - Dec. 1978
Jackson H. Priest, Willis B. Simpson, Larry D. McTigue, and William H. Lawler 20 Dec. 1978 74 p
(Contract DAAK40-78-C-0037)
(AD-A065673; D256-10529) Avail: NTIS HC A04/MF A01 CSCL 17/8

A precision optical pointing and alignment system (POPAS) was developed and installed in the Stabilized Mirror Automatic-Tracker Laser-Designator (SMAL) to reduce vibration-induced line-of-sight errors. Tests of the POPAS hardware have shown that it reduced RMS errors from 57 microradians to 7 microradians - a factor of 8 to 1 under simulated helicopter vibration environments. The POPAS consists of a collimated pulsed light source, optical path, detector, and error compensating control system. A pulsed laser diode beam is projected over the laser optical path, and reflected by a dichroic final fixed mirror. The reflected beam is returned over the same optical path. A detector measures the deflection of the beam, which is proportional to mirror vibration error. The detector output generates corrective commands to the stabilized mirror to compensate for the measured errors. Detailed design data and supporting test results are presented for POPAS. Author (GRA)

N79-24824# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.
GaAs ELECTROABSORPTION AVALANCHE PHOTODIODE WAVEGUIDE DETECTORS Final Report
C. M. Wolfe, W. S. C. Chang, R. O. Gregory, M. J. Sun, and K. H. Nichols Dec. 1978 66 p refs
(Contract N00014-75-C-1155)
(AD-A065986) Avail: NTIS HC A04/MF A01 CSCL 17/2

There has been substantial recent interest in optical information transfer and processing systems because of their present and potential advantages over conventional electronic systems. These advantages include elimination of interference and ground-loop problems; achievement of wide bandwidths and increased security; and reductions in weight, size, and cost. To achieve these advantages, the realization of GaAs-based integrated optical circuits (IOCs) appears to be particularly promising since coherent light sources, optical detectors, modulators, and other active devices can potentially be integrated on the same substrate with passive devices. For wide bandwidth IOCs a critical component is the optical detector which must have internal gain to provide optimum sensitivity. This internal gain can be obtained in photovoltaic detectors by means of avalanche multiplication and wide-bandwidth, high-gain, low-noise avalanche photodiodes have been fabricated in GaAs. However, the response of these conventional GaAs avalanche photodiodes decreases rapidly for wavelengths longer than about 0.86 micron. GRA

N79-24825# Harris Corp., Melbourne, Fla. Government Systems Group.
ARRAY SCANNING FOR IMAGE TRANSMISSION Final Technical Report, Sep. 1977 - Sep. 1978
W. C. Adams, Jr., T. R. Bader, J. J. Knab, E. B. Knick, Jr., and C. A. Shuman Griffiss AFB, N. Y. RADC Jan. 1979 390 p refs
(Contract F30602-77-C-0181; AF Proj. 6244)
(AD-A065583; RADC-TR-78-272) Avail: NTIS HC A17/MF A01 CSCL 17/2

This study effort evaluates the feasibility of utilizing one or two-dimensional arrays of image sensing and recording elements

rather than a single sensing and recording element in image transmission systems. This array scanning concept facilitates the implementation of many sophisticated image processing functions including bandwidth compression, image enhancement, modulation transfer function correction, and two-dimensional filtering. Extensive computer simulation of these processing functions and subjective analysis of the resulting imagery, along with the results of the array sensing and array recording feasibility evaluation, are used to formulate the trade-offs necessary to provide a conceptual system design and implementation. The conceptual design that is presented fully exploits the nature of the array scanning. Various practical aspects and system considerations regarding the conceptual design are treated. Author (GRA)

N79-24826# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
SCATTERING OF SOLAR RADIATION BY CLOUDS Interim Report
Stephen J. Young 5 Dec. 1978 48 p refs
(Contract F04701-78-C-0079)
(AD-A062828; TR-0079(4970-40)-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

Several simple models for computing the diffuse reflectance of solar radiation from plane-parallel cloud layers are formulated and assessed for accuracy. None of the models in their simplest form is suitable for application within the constraint of a factor of two accuracy. However, an empirical modification of the single-scattering model yields a procedure for computing the diffuse reflection coefficient with a nominal error of < 50 percent. Author

N79-24827# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
BROADBAND ZINC OXIDE TRANSDUCER FOR INTEGRATED OPTICS Final Technical Report, 1 Apr. - 31 Dec. 1977
D. Mergerian Wright-Patterson AFB, Ohio AFAL Jun. 1978 84 p refs
(Contract F33615-77-C-1030; AF Proj. 2001)
(AD-A062851; AFAL-TR-78-92) Avail: NTIS HC A05/MF A01 CSCL 20/6

The design and development of acousto-optic transducers on silicon substrates for use in integrated optical systems for RF spectrum analysis are presented. The transducers cover a minimum bandwidth of 250 MHz centered about 400 MHz and are capable of achieving transduction losses of 14dB or less at the frequency of minium loss. Two transducers designed and fabricated, one for use with 7059 Corning glass waveguides with a refractive index of 1.58 and the other for use with Nb2O5 waveguide of refractive index 2.10. The program called for the design and fabrication of broadband matching networks to match the transducers to a 50-ohm transmission line and permit the adjustment of phase between transducers in order to provide a response which is flat to 2 dB over the entire band. Measured transduction losses of less than the 14 dB goal were obtained, but, the propagation losses measured (in both the piezoelectric ZnO and in the waveguide layer) rule against the use of such transducers at higher frequencies. M.M.M.

N79-24828# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NEW TECHNIQUES FOR TRACKING SEQUENCES OF DIGITIZED IMAGES Ph.D. Thesis
Llewellyn S. Dougherty Nov. 1978 218 p refs
(AD-A066194; AFIT/DS/EE/78-4) Avail: NTIS HC A10/MF A01 CSCL 17/8

A model for a generalized image tracking system is presented. Characteristics of minimum norm similarity detectors are investigated. A first-order local tangent plane model for digitized imagery is used to successfully predict properties of the auto and cross distance functions for real data. A matrix signal-to-noise ratio is shown to be the natural signal-to-noise ratio for the minimum norm detection problem, and an approximation is derived and experimentally verified for an upper bound on the probability that a minimum norm detector makes a particular error. A non-linear two-dimensional filter is presented which shows a significant reduction in noise variance in low contrast regions of an image. An optimum weighted norm is derived which minimizes the probability of making a registration error, and an adaptive reference set selection algorithm is presented which maximizes the tracking signal-to-noise ratio. The adaptive reference set selection algorithm uses the histogram of gradient magnitudes and includes a new gradient estimator/classifier with a fixed probability of error. An adaptive Kalman filter is developed to update the reference image and the filter is shown to be stable in all areas of interest. Author (GRA)

N79-24829# Oxford Univ. (England). Engineering Lab.
THE SCANNING OPTICAL MICROSCOPE
T. Wilson 1978 27 p refs Sponsored by UK Sci. Res. Council
(OUEL-1243/78) Avail: NTIS HC A03/MF A01

A scanning optical microscope using a laser rather than electron beam was developed in order to gain high resolution and contrast images of living specimens. The instrument operates by focusing the laser beam on a diffraction limited spot that is scanned relative to the specimen in a TV-like raster. Besides reflected or transmitted light, photovoltaic energy and specimen-generated optical harmonics can serve as signals for forming images. Two varieties of this microscope are described differing as to whether reflected or transmitted light is collected by a lens and focused onto a pinhole placed in fron of the photodetector. It is mathematically demonstrated that including such a device enhances the reponse of the microscope to non periodic objects and allows better observation of details within thick objects. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-24830 South Carolina Univ., Columbia.
OPTIMIZATION AND APPLICATION OF MICROWAVE-EXCITED DISCHARGES Ph.D. Thesis
David C. Otto 1978 110 p
Avail: Univ. Microfilms Order No. 7911849

A study of the experimental parameters influencing the behavior of Electrodeless Discharge Lamps (EDL's) was undertaken. Parameters such as, fill gas, fill gas pressure, the mass of material introduced into the lamp, and lamp shape were investigated. These experimental parameters were adjusted to optimize the intensity of emission, S/N, drift and coupling efficiency. An atmospheric pressure flowing argon plasma was applied as a detector for gas chromatography. This system was used to determine the concentration of nitrogen and its oxides in air samples. The fundamental electrical properties of the plasma such as, electron density, electron temperature and equivalent resistance were measured by the double probe method. The influence of the experimental parameters such as, power, flow rate, and sample input on the electrical properties were determined. Dissert. Abstr.

N79-24831 British Library Lending Div., Boston Spa (England).
PROBE MEASUREMENT TECHNIQUE IN A TOKAMAK
L. E. Zakharov and V. D. Shafranov 13 Feb. 1979 10 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 48, no. 6, Jun. 1978 p 1156-1160
(BLL-CTO/1563-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

A modification to the probe measurement technique in a Tokamak is proposed to allow for deviations from axial symmetry caused by gaps in the casing, the inductor magnetic core and other factors. It is shown that in the case of smooth perturbations of the symmetry, it is sufficient to supplement the traditional technique with measurements of the local transverse flux. A method of successive allowance for sources of asymmetry is analyzed for the general case when the perturbations cannot be considered to be smooth. Author

N79-24832 British Library Lending Div., Boston Spa (England).
EIGHTH EUROPEAN CONFERENCE ON CONTROLLED FUSION AND PLASMA PHYSICS: A REVIEW

M. S. Rabinovich 10 Nov. 1978 14 p Transl. into ENGLISH from Preprint no. 3, Lebedev Inst. of Physics, Moscow, 1978 14 p Conf. held at Prague, 19-23 Sep. 1977
(BLL-CTO/1485-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Topics covered at the conference and summarized include: (1) developments in tokamaks; (2) plasma confinement in a group of stellarators; (3) ion cyclotron and ion hybrid frequency heating; (4) high beta systems; (5) theoretical problems in tokamaks; (6) inertial confinement; (7) electron beam fusion; (8) high current ion beams; and (9) laser fusion. A.R.H.

N79-24833# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANOMALOUS PLASMA TRANSPORT DUE TO ELECTRON TEMPERATURE GRADIENT INSTABILITY
Sinji Tokuda, Tetsuo Kamimura, and Hiroshi Ito Jan. 1979 53 p refs
(IPPJ-369) Avail: NTIS HC A04/MF A01

The collisionless drift wave instability driven by an electron temperature inhomogeneity (electron temperature gradient instability) and the enhanced transport processes associated with it are studied using a two-and-a-half dimensional particle simulation code. The simulation results show that quasilinear diffusion in phase space is an important mechanism for the saturation of the electron temperature gradient instability. Also, the instability yields partical fluxes toward the hot plasma regions. The heat conductivity of the electron temperature perpendicular to the magnetic field is not reduced by magnetic shear but remains high, whereas the heat conductivity of the parallel temperature is effectively reduced, and the instability stabilized. Author

N79-24834# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COLLISIONLESS TEARING INSTABILITIES
I. Katanuma and T. Kamimura Jan. 1979 54 p refs
(IPPJ-370) Avail: NTIS HC A04/MF A01

Collisionless tearing modes and the enhanced transport associated with this instability are investigated theoretically and by using a two-and-one-half dimensional particle simulation code in a slab geometry. The effects of electrostatic fields on the instability are also considered. The initial current is found to diffuse along the perturbed magnetic field lines with the observed diffusion coefficient in good agreement with the theoretical prediction. Electrostatic effects have a tendency to enhance the tearing mode growth rate. The growth of the mode is observed to divide into three phases. In multi-mode tearing, a combination of magnetic islands is observed. Author

N79-24835# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SPACE- AND TIME-RESOLVED STUDY OF IMPURITIES BY VISIBLE SPECTROSCOPY IN HIGH DENSITY REGIME OF JIPP T-2 TOKAMAK PLASMA
K. Kadota, M. Otsuka, and J. Fujita Mar. 1979 18 p refs
(IPPJ-374) Avail: NTIS HC A02/MF A01

Time-resolved spatial profiles of Z in JIPP T-2 Tokamak plasmas were determined from the measurement of bremsstrahlung in the visible spectral region. Impurities accumulate in the plasma center in a high electron density regime. Light impurities of low ionization states move toward the region of lower electron temperatures in this regime and the density of these ions increases notably at the plasma periphery. Author

N79-24836# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILIZATION OF MAGNETOHYDRODYNAMIC INSTABILITIES IN A CURRENT-CARRYING STELLARATOR
K. Matsuoka and K. Miyamoto Feb. 1979 18 p refs
(IPPJ-368) Avail: NTIS HC A02/MF A01

Stable profiles against MHD instabilities are given in a cylindrical current-carrying stellarator. The comparison theorem, i.e., guiding principle for stabilization, is obtained in the same way as in a Tokamak. As the external rotational transform due to an $\ell = 2$ helical field increases, MHD properties in a stellarator are improved and the minimum value of $q(a)$ which provides simultaneous stabilization of MHD modes can be lowered less than 2 even without a conducting shell. In an $\ell = 3$ stellarator, however, the configuration becomes more unstable than in a Tokamak and strong tailoring of the current profile is necessary in order to stabilize MHD modes. Author

N79-24837# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROPAGATION OF ION ACOUSTIC CNOIDAL WAVE
Kimiaki Konno (Nihon Univ.), Teruo Mitsuhashi (Shiroyama Senior High School, Shiroya, Kanagawa), and Yoshi H. Ichikawa [1979] 25 p refs
(IPPJ-367) Avail: NTIS HC A02/MF A01

Higher order contributions in the reductive perturbation theory were reexamined for the nonlinear ion acoustic wave propagation under the periodic boundary condition. The boundary condition gives rise to renormalization terms. As a result of analysis carried up to the second order, the ion flux associated with propagation of nonlinear ion acoustic cnoidal wave is examined for various values of excitation frequencies. It is shown explicitly that the dependence of the ion flux on the wave amplitude becomes much weaker than that of quasi-linear theory at lower frequency. This illustrates that the averaged properties such as the averaged flux in genuine nonlinear systems depend on their nonlinear behavior in a very crucial way. Range of validity of so-called quasi-linear approximation appears to be restricted to very small amplitude of disturbance. G.Y.

N79-24838# Maryland Univ., College Park. Dept. of Physics and Astronomy.
OBSERVATIONS AND INTERPRETATIONS OF MAGNETIC-FIELD-LINE RECONNECTION AND TEARING IN A THETA PINCH Ph.D. Thesis
James Henderson Irby Jan. 1979 111 p refs
(PL-79-022; Tech-Rept-79-096; Physics-Publ-79-183) Avail: NTIS HC A06/MF A01

Measurements and calculations are presented of reconnection and tearing of magnetic fields in the Maryland fast theta pinch operated with initial bias and driving fields in opposite directions. Open magnetic field lines reconnect and form magnetic islands on time scales of the order of an Alfven transit time across the plasma sheath. Data in support of these conclusions consist primarily of extensive magnetic probe data used to map out the field lines, supplemented by spectroscopic temperature measurements, CO2 laser interferometry, and spatially resolved light measurements. Implications of these results for plasma confinement are discussed. Author

N79-24839# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CHARACTERISTICS OF FAST RESPONSE InSb SUBMILLIMETER DETECTOR
K. Ichimura, K. Sakai, K. Kawahata, and J. Fujita Mar. 1979 17 p refs
(IPPJ-T-31) Avail: NTIS HC A02/MF A01

A highly sensitive, fast responding n-InSb detector for the millimeter and submillimeter region was fabricated and optimized for use in measuring the electron cyclotron emission from Tokamak plasmas, in connection with bandpass filters or a rapid scanning Fourier transform spectrometer. The detector element is made of high purity n-type InSb and is in magnetic fields up to 12 kG. The spectral responsivity, response time and noise equivalent power of the detector are given. A.R.H.

N79-24840# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LOW-ENERGY PARTICLE EXPERIMENT Final Report
R. D. Sharp 28 Feb. 1979 122 p refs
(Contract N00014-72-C-0234)
(AD-A066150; LMSC/D673078) Avail: NTIS HC A06/MF A01 CSCL 04/1

This was a program directed toward an improved understanding of the sources and energization, transport and loss processes associated with the low-energy (keV) plasmas in the earth's magnetosphere, particularly as they relate to ionospheric perturbations and ionospheric-magnetospheric coupling. This program conducted a low-energy particle experiment on the S3-3 spacecraft. The experiment is still operating successfully and has made several major discoveries about previously unknown ionospheric acceleration mechanisms and the composition of the ring current. GRA

N79-24841# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. School of Engineering.
DISCHARGE PROCESSES IN THE OXYGEN PLASMA Ph.D. Thesis

John W. Dettmer Dec. 1978 315 p refs
(AD-A066196; AFIT/DS/PH/78-3) Avail: NTIS HC A14/MF A01 CSCL 07/2

The objectives of this study were to investigate the plasma existing in the positive column of an oxygen glow discharge and to determine the physical and chemical processes involved. Recently there has been a renewed interest in the oxygen plasma, an interest generated by the development of the laser. Oxygen has been postulated and used as both the lasing medium and the pumping medium in electrical and electrical-chemical lasers. Also, there has been a continuing interest in efficient production of ozone. Effective utilization of oxygen electric discharges require a knowledge of the oxygen plasma, a plasma which differs from other plasmas in many of its characteristics. For example, electrical glow discharges in oxygen have been observed to exist in two different forms: a low electrical impedance form which exhibits an oscillatory behavior and a high electrical impedance form which is relatively stable. The transition between the two forms occurs as a function of current density and gas pressure. GRA

N79-24842# Oak Ridge National Lab., Tenn.
ELMO BUMPY TORUS
L. A. Berry, C. L. Hedrick, and N. A. Uckan Mar. 1979 55 p ref
(Contract W-7405-eng-26)
(ORNL/TM-6743) Avail: NTIS HC A04/MF A01

Progress from a demonstration of macrostability to an increasingly detailed understanding of transport properties is reported. Collisionless scaling (tau/sub E/ increases with temperature) was observed, and the magnitude of the energy confinement time is consistent with neoclassical theory. Experiments on EBT-S (for scale) conducted at the increased magnetic field levels and higher microwave power and frequency made possible by a 28-GHz gyrotron development program are discussed. DOE

N79-24843# Oak Ridge National Lab., Tenn.
INFLUENCE OF GLOBALMAGNETIC PERTURBATIONS ON PLASMA BEHAVIOR IN ELMO BUMPY TORUS
B. H. Quon, R. A. Pandl, D. L. Colestock, F. M. Bieniosek, and H. Ikegami Feb. 1979 33 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6704) Avail: NTIS HC A03/MF A01

The sensitivity of plasma confinement to magnetic field error effects was tested experimentally using externally introduced global field errors on the ELMO Bumpy Torus (EBT)). Below a critical error field the plasma was observed to be essentially free from convective cells, toroidal currents, and instabilities. This observed critical value is comparable to a neoclassical critical field error, the ratio of the ion Larmor radius to the major radius of the torus. DOE

N79-24844# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory.
STUDY OF SIMILARITY FLOWS OF TWO COMPONENT LASER PRODUCED PLASMAS
D. Anderson, J. Faulkner, H. Wilhelmsson, K. Nishikawa (Hiroshima Univ.), and T. Tange (Hiroshima Univ.) 1977 23 p refs
Avail: NTIS HC A02/MF A01

The isothermal similarity flow of a two ion species blow-off plasma was studied using similarity solutions to expand previous approaches to single ion expansion problems. The method was found to yield profiles for electron density and velocity that were in good accordance with the intuitive physical picture and to provide a means for analyzing a two stream instability that occurs as a result of the differences in streaming velocitles of the two-ion species. Author (ESA)

N79-24845# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
A PERTURBATION EXPANSION FOR THE NONLINEAR SCHROEDINGER EQUATION WITH APPLICATION TO THE INFLUENCE OF NONLINEAR LANDRAU DAMPING
J. Weilund, Y. H. Ichikawa (Nagoya Univ.), and H. Wilhelmsson 1977 26 p refs Sponsored in part by Natl. Board of Energy Source Develop.
(CTH-IEFT/PP-1977-12) Avail: NTIS HC A03/MF A01

The Bogoliubov-Mitropolsky perturbation method was applied to the study of a perturbation on soliton solutions for the nonlinear Schroedinger equation. The results are compared to those of Karpman and Maslov using the inverse scattering method and to those of Ott and Sudan on the Korteweg-Devries equations. Nonlinear Landau damping and ion inertia were considered as alterations to the nonlinear Schroedinger equation. Author (ESA)

N79-24846# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
RESONANT MODES OF A TOROIDAL PLASMA IN THE LARGE MAJOR RADIUS APPROXIMATION
Magnus Bonnedal 1977 25 p refs
(CTH-IEFT/PP-1977-13) Avail: NTIS HC A02/MF A01

A homogeneous, cylindrical, hot, magnetically confined plasma, with respect to its resonant modes and its response to an exciting solenoid surrounding the plasma, was investigated in order to determine the suitability of radio frequency heating of thermonuclear plasmas to ignition temperatures. The results are expressed in a form suitable for computer calculations. Author (ESA)

N79-24847# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
COUPLED NONLINEAR SCHROEDINGER EQUATIONS INCLUDING GROWTH AND DAMPING
M. Lisak, B. Peterson, and H. Wilhelmsson Nov. 1977 9 p refs
(CTH-IEFT/PP-1977-14) Avail: NTIS HC A02/MF A01

An analytical and numerical analysis of a system of coupled nonlinear Schroedinger equations with complex coefficients describing wave-wave interaction in the presence of linear and nonlinear damping (growth) is discussed. Results confirm that an exact solitary solution exists for an arbitrary damping rate for one of the waves when the linear damping of the second wave is zero. In general, the wave envelopes are composed of dispersive shock waves which are explosively unstable. Author (ESA)

N79-24848# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
WAVE INTERACTION IN A BEAM-PLASMA SYSTEM IN THE PRESENCE OF DISPERSION AND HIGHER ORDER NONLINEAR EFFECTS
M. Lisak Nov. 1977 18 p refs
(CTH-IEFT/PP-1977-15) Avail: NTIS HC A02/MF A01

Third-order perturbation theory based on the method of multiple scales was applied in order to describe wave interactions in a beam-plasma system. The formalism includes simultaneous effects of dispersion and nonlinearities giving rise to self and mutual interactions. Some travelling wave solutions are obtained in special cases of physical interest. Author (ESA)

N79-24849# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and EURATOM-Fusion Research.
FLUCTUATIONS IN ACTIVE MOLECULAR PLASMAS
H. Wilhelmsson and I. P. Yakimenko (Acad. of Sci. of the Ukrain. SSR, Kiev) 1978 35 p refs
(CTH-IEFT/PP-1978-1) Avail: NTIS HC A03/MF A01

A theoretical investigation of the elecromagnetic fluctuations in a plasma medium containing active molecules (or ions) was made by applying a transition probability approach. General expressions were deduced for the field fluctuation spectra and some simple examples are given considering the charge density fluctuations in the active molecular plasma. Author (ESA)

N79-24850# Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
NITROGEN EXCITATION BY METASTABLE ARGON ATOMS [EXCITATION DE L'AZOTE PAR LES ATOMES METASTABLES D'ARGON]
M. Touzeau Jun. 1978 157 p refs In FRENCH
(LP-170) Avail: NTIS HC A08/MF A01

Energy transfer from metastable argon atoms to nitrogen

was systematically studied. Several quantitive results were obtained using a flowing afterglow spectroscopic technique. The experimental method is described. Results show that vibrational distribution of state C 3 Pi u and of the B 3 Pi g can be explained using a fermi-based perturbation model. The alternation of intensity from even to uneven levels and the differences in the components of the doublet GL were interpreted starting with symmetry considerations. Some theoretical problems remain unsolved, such as the contribution of the several metastable levels of argon atoms to transfer phenomena, and more experimental work will be necessary. Author (ESA)

N79-24944# Joint Publications Research Service, Arlington, Va.
TOKAMAK PHYSICS: THE 70TH BIRTHDAY OF L. A. ARTSIMOVICH (25 FEBRUARY 1909 TO 1 MARCH 1973)
B. B. Kadomtsev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 31-41 ref Transl. into ENGLISH from Priroda (Moscow), no. 2, Feb. 1979 p 21-27 (For primary document see N79-24941 15-99)
Copyright. Avail: NTIS HC A04/MF A01

N79-24949# Joint Publications Research Service, Arlington, Va.
POWER INDUSTRY APPLICATION OF MHD TECHNOLOGY
A. Sheyndlin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 19-22 Transl. into ENGLISH from Izvestiya (Moscow), 30 Mar. 1979 p 3 (For primary document see N79-24946 15-99)
Copyright. Avail: NTIS HC A03/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-24851 Fordham Univ., New York, N. Y.
STRUCTURE ANALYSES OF ORGANIC COMPOUNDS USING X-RAY CRYSTALLOGRAPHIC TECHNIQUES Ph.D. Thesis
Massud Shoja 1979 116 p
Avail: Univ. Microfilms Order No. 7910708

An X-ray crystal structure determination of the cis 2-isopropyl-5-aminothiocarbonyl-1,3-dioxane was carried out in order to define the orientation of the sulfur atom with respect to the dioxane ring, and also to investigate the possible existence of intramolecular hydrogen bonding. A CAD-4 diffractometer with CuK sub alpha radiation and Ni filter was used and the intensities of 2143 independent reflections were measured. The heavy atom method was employed and the position of the sulfur atom was located from the Patterson map. The remaining atoms of the molecule were found from the electron density and difference electron density map. It was found that an intramolecular hydrogen bond is formed between the amino group and an oxygen of the ring. Dissert. Abstr.

N79-24852 Rutgers - The State Univ., New Brunswick, N. J.
THERMAL CONDUCTIVITY OF GRANULAR ALUMINUM Ph.D. Thesis
Yen-Hwa Liang Hsu 1978 157 p
Avail: Univ. Microfilms Order No. 7910396

The thermal conductivites of granular aluminum films with normal electrical resistivities, ranging from 4.4 x 10 to the -5 power Omega-cm to 1.2 x 10 to the -2 power Omega-cm were measured in the temperature range 0.5K to 3.5K. The films are known to consist of metal grains whose size is about 30A, embedded in an Al2O3 matrix. For the films with resistivity less than 200 mu omega-cm the electronic and lattice contributions can be separated. The electronic thermal conductivity is shown to follow the Wiedemann-Franz law in the normal state and the BRT45 curve for a superconductor with scattering predominantly by the impurities in the superconducting state. For more impure films, the electronic contribution becomes small and eventually negligible as compared with the phononcontribution. The lattice contribution of the 30A-diameter grains is limited by the size of the grains and small compared to that of the aluminum oxide. This leaves the lattice thermal conductivity of the amorphous aluminum oxide only. Dissert. Abstr.

N79-24853 Cornell Univ., Ithaca, N. Y.
CARBON SEGREGATION ON PLATINUM, PALLADIUM AND COBALT SINGLE CRYSTAL SURFACES Ph.D. Thesis
John Christie Hamilton 1979 156 p
Avail: Univ. Microfilms Order No. 7910811

The equilibrium segregation of carbon to the (111) and (100) surfaces of platinum and palladium and to the (0001) surface of cobalt was studied. The crystals were doped by annealing in evacuated silica capsules with powdered reactor grade graphite at the desired precipitation temperature. Using Auger spectroscopy, the surface carbon coverage was measured as a function of temperature. The crystals were heated using pulsed dc current. An out of phase pulsed incident electron beam was used for Auger spectroscopy to avoid beam deflection by magnetic fields associated with the heating current. For the platinum crystals only precipitation was seen. For palladium and cobalt, segregation was observed with a transition between equilibrium surface phases. The use of bulk alloy variables is suggested for prediction of the presence or absence of surface segregation in binary alloys. Dissert. Abstr.

N79-24854 Houston Univ., Tex.
MICROSTRUCTURAL STUDY OF V2D BY X-RAY MEASUREMENTS Ph.D. Thesis
Hi-Sam-Ung Jo 1978 102 p
Avail: Univ. Microfilms Order No. 7909735

Using three different methods of X-ray measurements, vanadium host-atom displacements due to interstitial deuterium atoms were measured at room temperature. Assuming a super-structure long-range order parameter, S = 1, at room temperature, it is shown that the displacement along the pseudo-tetragonal c direction from average position in the ordered structure (DAZ) is 0.11 A. Assuming S = 0.85 at room temperature, DAZ is determined to be 0.12 A. From a consideration of the distortion tensor DAZ is 0.17 A. Therefore, DAZ lies between 0.11 A and 0.17 A. The temperature dependence of S was measured using the superstructure reflection intensity. In addition the temperature dependence of the a and c parameters of the ordered structure was measured. Temperature-dependent occupation probabilities were obtained for each interstitial site. Dissert. Abstr.

N79-24855 California Univ., Riverside.
SPECIFIC HEATS OF SINGLE CRYSTAL EUROPIUM SULFIDE, SELENIDE, AND TELLURIDE NEAR THEIR MAGNETIC PHASE TRANSITIONS Ph.D. Thesis
William Richard Johanson 1978 136 p
Avail: Univ. Microfilms Order No. 7911740

EuS data were analyzed with D' = D = 0 using three reduced temperature ranges. The parameters for the range t > .005 were chosen as representing data as close as possible to the peak without inclusion of rounding errors. EuTe was analyzed with D' = D = 0 over the range t > .001 with contraints on E, B, and alpha but a satisfactory fit was not obtained. With D' = D = 0 and three reduced temperature ranges, a satisfactory fit was obtained only for the ranges t > .005 and t > .007. Specific heat measurements were taken from 1 K to 20 K on EuTe to obtain its magnetic entropy, which is 17.0 J/mole K, 1.7% lower than predicted by thermodynamics. EuSe showed an increase in thermal relaxation time near T sub N of nearly two orders of magnitude after being annealed. Thermal hysteresis was observed in the peak at 2.8 K; this has been observed to accompany first order transitions. For the best EuSe crystal, T sub N = 4.596 K. A search was made from 4.3 K to 4.55 K for specific heat bumps corresponding to a possible line of transitions. With a .3% resolution in specific heat, no transition was detected. Dissert. Abstr.

N79-24856 Connecticut Univ., Storrs.
A NUCLEAR MAGNETIC RESONANCE AND BULK MAGNETIC SUSCEPTIBILITY STUDY OF Ni-Pd-P AND Ni-Pt-F METALLIC GLASSES Ph.D. Thesis

Lawrence Thomas Kabacoff 1978 129 p
Avail: Univ. Microfilms Order No. 7911378

Nuclear magnetic resonance absorption spectra were obtained for the P-31 nuclei in splat cooled metallic glasses at temperatures ranging from 70 K to room temperature and for resonance frequencies ranging from 4 to 16 MHz. The P-31 Knight shift for all compositions studied depended only on the P concentration and not on the concentration of Ni relative to the other transition metal, nor on whether the other transition metal was Pd or Pt. The Pt-31 NMR peak-to-peak linewidth for all compositions studied possessed a frequency dependence which was typical of a Knight shift distribution and indicated that P atoms in a metallic glass experience a variety of near neighbot configurations. The Knight shift and magnetic susceptibility data can be described by assuming a rigid two band model for the electronic structure (density of states) of these metallic glasses. There is evidence for a transfer of charge from the phosphorus to the transition metal atoms. Dissert. Abstr.

N79-24857 Kansas Univ., Lawrence.
ANOMALOUS IONIC CONDUCTIVITY IN SILVER BROMIDE AND SILVER CHLORIDE Ph.D. Thesis
Ko-Jun Kao 1978 249 p
Avail: Univ. Microfilms Order No. 7910569

The ionic conductivity of pure AgBr and AgCl crystals was measured for a range of temperature from 150 C to near the melting point. An on-line computer network is used for temperature measurement and data storage. At high temperature, where the sample resistance is low, a modified Mueller method is used for resistance measurement. A model with positive Frenkel defects is chosen for the fitting. When parameters of defects, obtained from a least-squares fit of the conductivity in the intermediate and low temperature range, are extrapolated to high temperatures, the observed conductivity shows a large excess over the extrapolated values. The size of the anomaly is expressed in terms of a correction to the free energy of formation needed to bring observed and calculated values of the conductivity into agreement. Comparison to diffusion of Na in AgBr and AgCl strongly supports the point of view that the anomaly arises primarily from an increase in defect concentration. Dissert. Abstr.

N79-24858 California Inst. of Tech., Pasadena.
ION BOMBARDMENT EFFECTS ON MATERIAL COMPOSITIONS: PREFERENTIAL SPUTTERING AND ATOMIC MIXING Ph.D. Thesis
Zong-Long Liau 1979 165 p
Avail: Univ. Microfilms Order No. 7909833

Composition changes in binary alloys and compounds as a result of rare-gas sputtering were observed by using Rutherford backscattering techniques. The results were interpreted in terms of a preferential sputtering, which generated enrichment of the heavy species at surface, in combination with an ion-induced atomic mixing effect, which propagated the composition change over a depth comparable to the ion range. The effect of atomic mixing and preferential sputtering on the evolution of very thin surface layers during sputter-etching was studied as well as the effect of atomic mixing in cases where the ion range penetrated through the interface between a surface metal film and an underlying Si-substrate. Results suggest that the ion-induced atomic mixing effect has the potential of producing thin-film materials with any desirable compositions or with compositions and structures unachievable by conventional metallurgical means. Dissert. Abstr.

N79-24859 Kent State Univ., Ohio.
A TEST OF CURVATURE ELASTICITY ABOVE THE NEMATIC-SMECTIC A PHASE TRANSITION Ph.D. Thesis
Stephen Joseph Majoros 1978 120 p
Avail: Univ. Microfilms Order No. 7909969

The linear theory of elasticity of the nematic phase of liquid crystals was tested using a magnetic deformation experiment. A homeotropically aligned sample of 4-n-phenyl-phenylythiol-4-octyoxybenzoate (8 bar S5) is placed in a magnetic field with the field direction perpendicular to the director and as the field strength is increased above the critical field the sample undergoes a nonuniform bend. An estimate of the temperature above the N-A (nematic-smectic) transition temperature, at which the nonlinearity in the elastic behavior should begin to be noticeable, can be obtained by noting that in superconductors, the quantity analagous to the elastic constant is the magnetic susceptability. It is estimated that the breakdown of linear elastic behavior in nematics may occur as far away as 1 C from the N-A transition. In 8 bar S5 it was found that the linear elastic theory was valid as close as 0.079 C to the N-A transition for a 185 micron sample and 0.188 C for a 90 micron sample. Dissert. Abstr.

N79-24860 Louisville Univ., Ky.
FACTORS INFLUENCING SEEBECK EFFECT OF THIN TELLURIUM FILMS Ph.D. Thesis
Habip Ozkaplan 1978 110 p
Avail: Univ. Microfilms Order No. 7909728

Tellurium films were deposited and maintained in a vacuum during the course of the electrical measurements. The conductivity, Seebeck emf and Seebeck coefficient were determined as a function of temperature difference for films of thickness 100 to 2000 A. All the films showed a parabolic relationship between Seebeck emf and temperature difference. The Seebeck coefficient was, therefore, a linear function of the temperature difference and it was of positive sign. Dissert. Abstr.

N79-24861 Cornell Univ., Ithaca, N. Y.
THE VISCOSITY OF NORMAL AND SUPERFLUID HELIUM THREE Ph.D. Thesis
Jeevak Mahmud Parpia 1979 124 p
Avail: Univ. Microfilms Order No. 7910767

The viscosity of the normal liquid was measured at a variety of pressures ranging from the saturated vapor pressure to twenty nine bars using a torsional oscillator. The pressure dependence of the normal liquid differs significantly from previous measurements at saturated vapor pressure. The viscosity in close proximity to the superfluid transition was also measured. The true temperature dependence of the viscosity was observed and compared to existing theories. These measurements disagree sharply with those performed by earlier workers. The viscosity and other collision parameters differ quantitatively from those of the s-p approximation. However, using existing theories, the results in the superfluid were linked to the normal liquid viscosity. Dissert. Abstr.

N79-24862 California Univ., Riverside.
HOST NUCLEAR SPIN RELAXATION IN SUPERCONDUCTING ALLOYS OF 3D TRANSITION METALS IN ALUMINUM Ph.D. Thesis
Kiumars Parvin 1978 124 p
Avail: Univ. Microfilms Order No. 7911754

Nuclear spin-lattice relaxation times for Al-27 were measured in the normal and superconducting dilute alloys of 3d transition metals in aluminum. These measurements were carried out to obtain information regarding the nature of 3d impurities (Mn, Cr, V) through their effects on superconducting aluminum. The relaxation-time data reveal the existence of an unexpectedly large broadening in the quasi-particle density of excited states at the gap edge, relative to that predicted within the Hartree-Fock approximation to the model of nonmagnetic 3d impurities in aluminum. Dissert. Abstr.

N79-24863 Arizona State Univ., Tempe.
HIGH RESOLUTION ELECTRON MICROSCOPY OF SULFIDES Ph.D. Thesis
Larry Stephen Pierce 1979 207 p
Avail: Univ. Microfilms Order No. 7911115

Sulfide structures of pyrrhotite and the bornite-digenite were studied in detail to show the usefulness of electron microscopy. The pyrrhotite samples studied were found to consist of intimate mixtures of several basic structure types: 4c, 5c, Nc and Na. A range of bornite-digenite superstructures, 2a to 6a in size, were imaged. Dark field high resolution imaging was found to provide approximately twice the resolution available from bright field imaging. The dark field images were surprisingly representative of projected structure, providing a very straightforward interpretation using comparison images of known structures. High resolution dark field electron microscopy was an extremely useful tool in the study of complex sulfide crystal structures, providing valuable information not available through conventional techniques. Dissert. Abstr.

N79-24864 Florida Univ., Gainesville.
HIGH-TEMPERATURE SERIES EXPANSION FOR THE SINGLET-TRIPLET MODEL Ph.D. Thesis
Kenneth Alan Rauchwarger 1978 176 p
Avail: Univ. Microfilms Order No. 7909790

A Green's function diagrammatic technique using standard basis operators was employed in the high temperature series expansion of the correction to the effective field free energy. The evaluation of diagrams is performed in the Fourier space, in which the diagrams contain summations over all momentum and frequency variables. Algebraic expressions for the large number of frequency summations which appear are analytically generated by computer. Five terms in the high temperature series expansion for the free energy and the susceptibility for the single-triplet model are obtained. The series expansion is valid for arbitrary energy splitting between the singlet level and the triplet level and allows for arbitrary range of exchange interaction and lattice geometry. Results also allow for arbitrary exchange interaction anisotropy. From these results the critical temperature as a function of the crystal field to exchange interaction ratio is estimated for the three cubic lattices of the nearest neighbor interaction model for the two special cases of Heisenberg exchange interaction. Dissert. Abstr.

N79-24865 Florida Univ., Gainesville.
SUPERCONDUCTING AND NORMAL STATE PROPERTIES OF HEXAGONAL CESIUM TUNGSTEN BRONZE Ph.D. Thesis
Mark Roland Skokan 1978 124 p
Avail: Univ. Microfilms Order No. 7909799

The chemical potential, Seebeck coefficient, metallic resistivity, superconducting transition temperature, and superconducting upper critical field of single crystals of hexagonal Cs sub x WO3 ($0.19 < \text{or} = x < \text{or} = 0.33$) were measured. The data show that correlations exist among these various properties and between the properties and the Cs concentration (as determined by X-ray fluorescence) of the sample crystals. While certain of the normal state variations can be explained in terms of the change in charge carrier concentration with x-value, the unusual behavior of rho near $x = 0.24$ and the overall enhancement of the superconducting properties with decreasing x lend credence to a more lattice-related model, in which the increasing vacancies produced by decreasing Cs content affect electron-phonon coupling. Dissert. Abstr.

N79-24866 New Orleans Univ., La.
MEASUREMENT OF THE THERMAL EMISSION OF TUNGSTEN AND ANALYSIS OF ELECTRON RELAXATION EFFECTS Ph.D. Thesis
Douglas Peter Verret 1978 100 p
Avail: Univ. Microfilms Order No. 7911287

The temperature variation of the total hemispherical emissivity epsilon sub h of an electropholished surface of 3N8 pure tungsten was investigated with a transient calorimetric technique in the range 180-1000 K. Two separate apparatuses were utilized, one for measurements below room temperature and the other for measurements above room temperature. The experimental data obtained are believed to be the first ever obtained on tungsten below 273 K and also the first ever obtained on electropolished tungsten above that temperature. It is found that for $T < 600$ K, the epsilon sub h the vs T curve is almost linear with a nearly constant slope and also well below the predictions of the classical theory of Davisson and Weeks. The latter theory assumes that the electron relaxation time in a metal is negligible and that epsilon sub h is only dependent upon the dc resistivity and the temperature. Dissert. Abstr.

N79-24867 Clemson Univ., S.C.
LOW TEMPERATURE PROPERTIES OF BISMUTH FILMS IN LARGE ELECTRIC AND MAGNETIC FIELDS Ph.D. Thesis
Theron Otis Walker 1978 110 p
Avail: Univ. Microfilms Order No. 7909406

Polycrystalline bismuth films were prepared by vacuum deposition onto mica substrates held at 423 K and onto glass substrates held at room temperature. Continous plots of the film resistance as a function of an applied transverse magnetic field were obtained for field values ranging from zero to 5 T. The resistance was seen to increase quadratically with field for low fields and then to saturate at high fields. Measurements of the Hall voltage as a function of an applied magnetic field revealed an anomalous positive Hall constant at low fields for most of the films. The modulation of the film resistance as a function of an applied transverse electric field, was measured in the presence of an applied transverse magnetic field. It was found that the magnitude of the electric field effect increased as a function of the applied magnetic field for fields higher than 2 T. Dissert. Abstr.

N79-24868 Connecticut Univ., Storrs.
PHOTOEMISSION AND OPTICAL STUDIES OF FREE BASE TETRAPHENYLPORPHYRIN AND MAGNESIUM TETRAPHENYLPORPHYRIN Ph.D. Thesis
Beatrice Sun Wei 1978 176 p
Avail: Univ. Microfilms Order No. 7911420

The yield and energy distributions are measured from the threshold of response (around 6 eV for both samples) to 11.4 eV. The energy distribution data are analyzed to determine the optical densities of initial states. Three peaks are found in the optical density of initial states for both materials studied, with strengths of peaks increasing toward deeper lying energy states. Reflectivity is measured for photon energies between 1.9 and 13.5 eV. In the optical spectra, the low energy Q and B transitions were observed. Strong transitions from different initial states to continum states were also evident at energies beyond the Soret band. These continuum excitations are observed in photoemission experiments as well, but the optical data additionally include detailed discrete transitions. The conclusion is that the main optical features arise from transitions associated with the conjugated ring of the porphyrin skeleton, with fine structure superimposed due to the localized benzene excitations. Dissert. Abstr.

N79-24869 Rutgers - The State Univ., New Brunswick, N. J.
AN INVESTIGATION OF EFFECTS ASSOCIATED WITH THERMAL COUNTERFLOW IN ROTATING SUPERFLUID HELIUM Ph.D. Thesis
Edward John Yarmchuk 1978 132 p
Avail: Univ. Microfilms Order No. 7910457

The mutual friction force between the normal and superfluid components of He studied by measuring the temperature and chemical potential gradients which arise when thermal counterflow is imposed transverse to an array of quantized vortex lines. A very sensitive temperature gradiometer system was developed in order to measure the extremely small temperature gradient which is produced. The magnitude of the mutual friction force as determined by the temperature gradient measurements was found to be in reasonable agreement with the results of others using a widely different technique. A device capable of direct chemical potential difference measurements is described. Using this device, the chemical potential gradient associated with vortex line motion was observed. In addition, effects which are attributable to vortex line pinning were seen. Dissert. Abstr.

N79-24870 Ohio Univ., Athens.
NEUTRON SCATTERING ON EVEN ISOTOPES OF TIN Ph.D. Thesis
Mohammed Caesareon Mirzaa 1978 250 p
Avail: Univ. Microfilms Order No. 7909458

The differential elastic and inelastic scattering cross-sections at 11 and 24 MeV, and total cross-sections for neutrons between 5-12 MeV and 20-26 MeV, were measured for Sn-116, -118, -120, -122 and -124. The data was analyzed to determine the energy and isospin dependence of both the real and imaginary parts of the potential as well as to search for an appropriate nuclear radius dependence on the mass number A for the tin isotopes. The search for optimum optical model pitential parameters was done with the automatic search code GENOA. The analyses of the data at energies higher than 20 MeV show that total cross-section data alone is not sufficient in determining the energy and isospin coefficient and at differential cross-section data is needed, at one energy at least, for accurate determination of these coefficients. The dependence of the nuclear radius R on the mass of the target A was also investigated. Dissert. Abstr.

N79-24871 Clemson Univ., S.C.
CYLINDRICAL JOSEPHSON TUNNELING Ph.D. Thesis
Manjul Bhushan 1978 111 p
Avail: Univ. Microfilms Order No. 7909405

Measurements of the Josephson tunneling current between thin cylindrical superconductors in an axial magnetic field are presented and compared with the theory which is developed. Pairs of thin tin film cyclinders were deposited on plastic optical fibers of 25 microns radius and quartz fibers of several sizes down to 3.5 microns radius. The inner tin film was oxidized in an oxygen glow discharge prior to the deposition of the second film. The Josephson currents decreased with field much as predicted by the theory but the cyclinders were always in the same quantum states i.e., n sub 1 = n sub 2. Additional experiments on cylinders smaller than the coherence length in radius are proposed. Dissert. Abstr.

N79-24872 State Univ. of New York at Stony Brook.
INFLUENCE OF THERMAL DISORDER ON ELECTRONIC PROPERTIES OF SOLIDS Ph.D. Thesis
Bulbul Chakraborty 1979 113 p
Avail: Univ. Microfilms Order No. 7911328

The effect of temperature and impurities on dc conductivity and optical properties of solids is studied with special attention given to the features which are present for Bloch electrons but do not exist for a free-electron gas. Using an equation of motion method, a generalized Boltzmann equation valid for both intra- and interband conduction is obtained, and a systematic theory for both the shift and broadening is developed. New results for the change in dc dielectric constant of a semiconductor are presented. The generalized equation is also applied to the problem of dc transport. The infrared conductivity is derived. It is shown that some of the corrections involved in the formula for dc resistivity can be independently obtained from infrared experiments. Corrections to the standard result for thermal conductivity and thermopower are presented in an appendix.
Dissert. Abstr.

N79-24873 Cornell Univ., Ithaca, N. Y.
SUPERFLUID 3He IN NARROW CYLINDERS Ph.D. Thesis
Christopher Michael Gould 1979 160 p
Avail: Univ. Microfilms Order No. 7910806

Superfluid He to the minus 3 power was confined to the interior of very long 2 micron diameter cylinders and studied with continuous wave nuclear magnetic resonance. An external static magnetic field was placed both along and perpendicular to the cylinder axes, and the radio-frequency field was oriented in order to study both longitudinal and transverse resonance modes. With the static magnetic field along the cylinder axes the longitudinal resonance shows one well-defined resonance at a frequency which is roughly .8 times the bulk longitudinal frequency. The transverse spectrum has two peaks whose shift frequencies are roughly .6 and .9 times that of bulk liquid. In both longitudinal and transverse modes the ratios of frequencies in confined liquid to that in bulk liquid are temperature dependent. With the magnetic field perpendicular to the cylinder axes the transverse resonance shows one peak between the Larmor frequency and that of bulk liquid, but its temperature dependence cannot be characterized in any simple fashion.
Dissert. Abstr.

N79-24874 Nebraska Univ. - Lincoln.
A STUDY OF THE GALERKIN-DORODNITSYN METHOD APPLIED TO A THREE-DIMENSIONAL, QUASI-STEADY MELTING PROBLEM WITH A MOVING IRRADIATION SOURCE Ph.D. Thesis
Kurt Frederick Buckley 1978 169 p
Avail: Univ. Microfilms Order No. 7910494

An infinite slab of finite thickness was considered. The Galerkin method was applied in one dimension, along the irradiation axis to each of the four regions characterized by two phases and two top surface boundary conditions. The solid-liquid interface equations were then transformed into the governing equations with two unknowns. Finally, the Dorodnitsyn method was applied in two dimensions to solve for the interphase surface. A major discovery in the course of the investigation was that the shape of the interphase surface can be determined in a manner decoupled from and preceding the temperature calculations. Numerical results on the width and depth of the liquid pool were compared with laboratory measurements demonstrating the feasibility of the solution method and implementation technique.
Dissert. Abstr.

N79-24875*# Naval Research Lab., Washington, D. C.
GALLIUM-DOPED GERMANIUM, EVALUATION OF PHOTOCONDUCTORS, PART 1 Final Report, Dec. 1976 - Sep. 1978
W. J. Moore 12 Apr. 1979 56 p refs
(NASA Order RA-32035-B)
(NASA-CR-152222; NRL-MR-3939-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 20L

Gallium-doped germanium far infrared detectors were evaluated at low temperatures and low background simulating the space environment. Signal and noise characteristics were determined for detector temperatures in the 2K to 4K range. Optimum performance occurs at about 2.5K for all devices tested. The minimum average NEP in the 40-130 micron region was found to be approximately 4 x 10 to the minus 17th power watt Hz(-1/2) at a frequency of 1 Hz. J.M.S.

N79-24876# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
CONTACTLESS MEASUREMENT OF CARRIER GENERATION RATE IN SEMICONDUCTORS
R. Bharat (Rockwell Intern., Anaheim, Calif.), P. Das, R. T. Webster, and H. Estrada-Vazquez 1978 15 p refs
(Contract N00014-75-C-0772; Grant AF-AFOSR-3426-77; AF Proj. 2306)
(AD-A062880; AFOSR-78-1550TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

A measurement technique for determining the mobile charge carrier generation rate in the vicinity of a semiconductor surface is proposed. The technique uses a surface acoustic wave (SAW) propagating on the surface of a piezoelectric substrate to probe the surface of the semiconductor sample placed adjacent to it. The SAW attenuation in response to a transverse voltage pulse applied across the semiconductor by means of field plates provides the needed information; hence no electrical contacts are required on the semiconductor. Data are presented using this technique for a silicon/lithium niobate combination. This contactless measurement provides a method of determining the effect of specific wafer processing steps on dark current levels which limit the performance of semiconductor memory and imager arrays. Author

N79-24877# California Univ., Livermore. Lawrence Livermore Lab.
SYSTEMATIC COMPUTATION OF THE PERFORMANCE OF PHOTOVOLTAIC BASED ON FIRST PRINCIPLES
J. H. Yee 29 Jan. 1979 38 p refs
(Contract W-7405-eng-48)
(UCID-1804-Pt-1; Rept-1) Avail: NTIS HC A03/MF A01

The minority lifetime and the minority diffusion length were theoretically estimated for both the single crystal and polycrystalline film of Cu2S, Cu2O,and CdTe. The mobility of the electron as a function of the temperature was calculated for the Cu2O single crystal based upon the simple model of the electron-polar optical phonon interaction. It was shown that the existing data on the hole mobility of Cu2S can be explained very well by a simple model of grain boundary scattering. The effect of impurity and defect on the minority carrier lifetime and the minority diffusion length was discussed. A model for the energy structure of Cu2S was proposed. This energy band model explains very well the experimental data for the absorption coefficient. DOE

N79-24878# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN DEPTH PROFILING USING ELASTIC RECOIL DETECTION
B. L. Doyle and P. S. Peercy 1979 12 p refs Presented at Workshop on Anal. of Hydrogen in Solids, Albuquerque, N. Mex., 23-25 Jan. 1979 Submitted for publication
(Contract EY-76-C-04-0789)
(SAND-79-0210C; Conf-790127-2) Avail: NTIS HC A02/MF A01

The elastic recoil detection (ERD) analysis technique for H profiling in the near surface regions of solids is described. ERD

is shown to have the capability of detecting H and its isotopes down to concentrations of approximately 0.01 at. % with a depth resolution of a few hundred angstroms. It is demonstrated that 2.4 MeV He ions can be used successfully to profile H-1 and D-2 using this technique. DOE

N79-24879# Los Alamos Scientific Lab., N. Mex.
STABILITY AND DEGRADATION OF SUPERCONDUCTING CURRENT-CARRYING DEVICES
S. L. Wipf Dec. 1978 16 p refs
(Contract W-7405-eng-36)
(LA-7275) Avail: NTIS HC A02/MF A01

Several resistive zones which are separated by superconducting zones were analyzed. Periodic temperature solutions and superconducting zones of minimum size which prevent the coalescence of resistive zones were the resultants. The dependence on normal resistivity allows the choice of an optimal ratio of superconductor to stabilizer. The disturbance spectrum (DS) is discussed, and possible disturbances are characterized qualitatively and with estimates of their size. The quench current can be obtained by comparing the basin of attraction (BOA) and DS. Improvements in stability are obtained by reducing the DS and enlarging the BOA. The influence of operational and design variables is discussed. DOE

N79-24880# Varian Associates, Palo Alto, Calif.
RESEARCH ON LATTICE-MISMATCHED SEMICONDUCTOR LAYERS Quarterly Progress Report, Aug. - Oct. 1978
R. L. Moon Nov. 1978 14 p refs
(Contract EY-76-C-03-1250)
(SAN-1250-4; QPR-1) Avail: NTIS HC A02/MF A01

Although the AlGaAsSb system is well suited for a two bandgap solar cell because of the ability to grow all the necessary junctions and window layers at a common lattice parameter value. The lattice mismatch between the substrate and the GaAsSb alloy composition for the low bandgap cell reduces the cell performance. Several ways of improving this situation are examined. One way is to maximize the performance for the existing minority carrier diffusion lengths. This requires growing thicker than usual p-type GaAsSb layers. Another method is to grow on a substrate-oriented (100) rather than (111) in order to reduce dislocation bunchings which often have densities > 10 to the 7th power/sq cm. Finally, the VPE growth of the ternary and quaternary antimonide compounds by organometallic may result in longer minority diffusion lengths by either improving the dislocation morphology or by reducing the trap densities. Experiments in these three areas are discussed. DOE

N79-24881# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
CHARACTERIZATION AND GROWTH OF EPITAXIAL LAYERS OF GaAs EXHIBITING HIGH RESISTIVITY FOR IONIC IMPLANTATION Final Report [CROISSANCE ET CARACTERISATION DES COUCHES EPITAXIALES DE GaAs DE HAUTE RESISTIVITE POUR IMPLANTATION IONIQUE]
Dec. 1977 90 p refs In FRENCH
(Contract DGRST-76-7-0067)
(LEP-78/19.SME-441-H) Avail: NTIS HC A05/MF A01

Using classic epitaxial growth techniques at low temperatures, it is possible to control GaAs layer deposition on semi-isolant substrates while obtaining the desired purity and resistivity. Original characterization methods such as photohall and spectroscopy, in function of depth, show two regions. One is very pure and of high mobility; the other is a dead layer, nearer the substrate, very resistive and strongly compensated. This compensation is attributable to light acceptor diffusion (C, Cu) and deep center (Cr or Fe) diffusion, starting from interface. The implantation of Se ions in the layers makes possible FET devices with improved performance compared to direct implantation on the substrate.
Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N79-24882 California Univ., Santa Barbara.
NEUTRINOS AND LONG-RANGE WEAK FORCES IN COSMOLOGY Ph.D. Thesis
Vinod Bhagwandas Jhangiani 1978 384 p
Avail: Univ. Microfilms Order No. 7911654

The Lorentz and coordinate covariant calculus of spinors in Riemannian spacetime, which is the mathematical model for the description of the quantum mechanics of elementary particles with spin interacting with classical gravitation field, is explored. The Dirac equation describing the interaction of neutrinos with travitational fields of the Robertson Walker cosmological world models is separated, and the spectrum of eigenfunctions and eigenvalues for particular choices of the set of quantum numbers is given explicitly for the $k=0$ and $k=+1$ models. The mathematical theory of the motion of a perfect fluid whose elements interact via long-range neutrino-exchange forces, as well as gravitationally, is developed. This theory is used to calculate the effects of long-range Weak interaction forces arising from multiple neutrino exchange on the dynamical evolution of the Robertson-Walker cosmological world models. Dissert. Abstr.

N79-24883 Texas Univ. at Austin.
NUMERICAL SIMULATION OF SPHERICALLY SYMMETRIC MATTER IN RELATIVITY Ph.D. Thesis
Jorge Pacheco Bellet 1978 232 p
Avail: Univ. Microfilms Order No. 7910933

The numerical problem posed by Einstein's equations is examined for the simple case of spherical symmetry. The general approach taken is solve the initial value equations in either the York and O'Murchadha formalism or the thin Sandwich formalism, and then to let the computer evolve the field equations in Arnowitt-Deser-Misner form. The initial value equstions are solved numerically for a class of problems of astrophysical import, namely relations a choice of gauge corresponding to maximal slicing and comoving coordinates is made. The numerical evolution is carried out for four initial data sets, two of them yielding continuous gravitational collapse and the other two collapse and bounce. The results are presented in graphical form. Dissert. Abstr.

N79-24884 Temple Univ., Philadelphia, Pa.
CONSEQUENCES OF THE RENORMALIZATION GROUP FOR THE THERMODYNAMICS OF FLUIDS NEAR THE CRITICAL POINT Ph.D. Thesis
Koo Ley, Marcos 1979 130 p
Avail: Univ. Microfilms Order No. 7910064

General renormalization group predictions, for the functional form of a thermodynamic potential, have been used to study the thermodynamic behavior of a simple fluid in the vicinity of its critical point. This has allowed the derivation of expansions in non-integer powers of the reduced temperature t for a number of thermodynamic quantities including the sum and difference of coexisting densities. In addition, similar expressions have been obtained to describe the behavior along other trajectories of experimental interest such as the critical isochore and isotherm. It is found that the diameter of the coexistence curve will be non-linear with a system dependent coefficient and a temperature derivative which diverges as the constant volume specific heat at the critical point. The form of the most important correction to scaling terms as well as the relation between measurables quantities and parameters which may be calculated by renormalization group are determined. Dissert. Abstr.

N79-24885 Colorado Univ. at Boulder.
TIME DELAY IN QUANTUM SCATTERING Ph.D. Thesis
Remigio Gonzalgo Tee 1978 78 p
Avail: Univ. Microfilms Order No. 7911479

A rigorous time-dependent study of time delay within the framework of Hilbert space formalism is presented. Related results

on the total time a quantum particle spends inside some bounded regions in position space are also presented. It is proven that any two free particles having identical distributions of energy and angular momentum take exactly identical expectation values for the transit time across an arbitrary spherical region centered at the origin in position space. Ways to extend this result to nonfree Hamiltonians are indicated. The relationship between the position operator and the Eisenbud-Wigner time delay operator is examined. Dissert. Abstr.

N79-24886 North Texas State Univ., Denton.
FLUID SPHERES IN GENERAL RELATIVITY: EXACT SOLUTIONS AND APPLICATIONS TO ASTROPHYSICS Ph.D. Thesis
Patrick Gene Whitman 1978 109 p
Avail: Univ. Microfilms Order No. 7911097

Exact solutions to Einstein's field equations in the presence of matter are presented. A one parameter family of interior solutions for a static fluid is discussed. It is shown that these solutions can be joined to the Schwarzschild exterior, and hence represent fluid spheres of finite radius. Contained within this family is a set of solutions which are gaseous spheres defined by the vanishing of the density at the surface. An analytic expression is given for degenerate neutron gas is given for and the stability of equation which yield expressions relevant to neutron is assessed. A class of analytic expressions are derived which depict rotating neutron stars assuming only that the rate of spinning is slow compared to the velocity of light. Time dependent solutions to the field equations possessing spherical symmetry are considered. A method is developed which permit extraction of quasi-static equations. Collapsing stellar models are considered as an application of this technique. Dissert. Abstr.

N79-24887# Oxford Univ. (England). Engineering Lab.
ON THE MATHEMATICAL FORMULATION OF THE FIRST PRINCIPLE OF THERMODYNAMICS FOR NON-UNIFORM TEMPERATURE PROCESSES
A. Paglietti 1978 34 p refs Sponsored by NATO
(OUEL-1251/78) Avail: NTIS HC A03/MF A01

In a system at non-uniform temperature some of the heat which flows from hotter regions to colder ones can produce nonthermal energy quite apart from whether or not the system undergoes changes in its state. A general mathematical formulation of the first principle of thermodynamics is given which explicitly takes into account the nonthermal energy originating from the heat flow. Moreover, some restrictions imposed by the second principle of thermodynamics on this production of nonthermal energy are determined. Once the present formulation is adopted, it is shown that the energy of a quantity of calories in motion in a non-uniform temperature field cannot be obtained simply by multiplying the number of calories times the Joules equivalent of heat. An explicity expression of this energy is deduced for steady-state situations. The consequences of the proposed formulation on heat conduction problems are discussed. Some experimental evidence is given in support of the present approach. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N79-24888*# National Aeronautics and Space Administration, Washington, D. C.
SIGNIFICANT CHARACTERISTICS OF SOCIAL RESPONSE TO NOISE AND VIBRATION
Guen Nishinomiya Apr. 1979 19 p refs Transl. into ENGLISH from the J. of the Acoust. Soc. of Jap. (Japan), v. 32, no. 3, Mar. 1976 p 147-155 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75412) Avail: NTIS HC A03/MF A01 CSCL 05K

Several surveys made since 1971 to investigate annoyance resulting from noise and vibration, from various sources were studied in order to quantify the relation between annoyance response to noise or vibration and properties of the respondent including factors such as noise exposure, etc. Samples collected by the social surveys and physical measurements were analyzed by multi-dimensional analysis. A.R.H.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-24889# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPLORATORY STUDY FOR DESIGN OF A PROPULSION DEPUTATE MANAGEMENT INFORMATION SYSTEM M.S. Thesis
Bruce E. Wallachy Sep. 1978 100 p refs
(AD-A065883; AFIT/GSM/SM/78S-25) Avail: NTIS HC A05/MF A01 CSCL 05/1

The primary objective of this thesis effort is the development of a plan for the design and implementation of a management information system (MIS) in the Deputate for Propulsion. To accomplish the task the MIS development ideas and concepts presented by MIS experts in the literature sources are examined and applied to the organization and its work. Specific actions and agents are then identified for the MIS development. Since the development process for the Deputate is in its initial stages at the time of this thesis effort, special attention is paid to identifying actions which initially help orient the development toward a successful system. Author (GRA)

N79-24890# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF A HUMAN INFORMATION PROCESSING MODEL FOR DECISION MAKING M.S. Thesis
David R. Unger Sep. 1978 119 p refs
(AD-A065912; AFIT/GSM/SM/78S-23) Avail: NTIS HC A06/MF A01 CSCL 05/10

This research examined information overload in decision makers by means of a human information processing model developed by Schroder, Driver, and Streufert. That model provided that the ability of an individual to integrate data into a decision varied in a curvilinear fashion with the complexity of the information environment. Information processing capacity was hypothesized to increase up to a certain optimum level and then decrease, marking the onset of information overload. A policy capturing exercise was employed to measure the amount of information processed for three different levels of information availability. Subjects were given sets of four, six, or eight national problem areas along with hypothetical priorities that the federal government was said to attach to those problems. The subjects indicated their levels of agreement or disagreement with each set of priorities. Regression analysis was then used to discover how many of the available problem areas contributed significantly to the three sets of decisions. The information utilization patterns were compared to the predictions of the model. GRA

N79-24891# North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
PUBLIC PARTICIPATION IN 208 WATER QUALITY PLANNING: A CASE STUDY OF TRIANGLE J COUNCIL OF GOVERNMENTS, NORTH CAROLINA
Steven Herzberg Apr. 1978 72 p refs
(Contract DI-14-34-0001-8035)
(PB-290587/5; W79-03666; OWRT-A-096-NC(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

The experience of participants in a completed regional water quality planning process is documented in order to offer guidance to the state-wide planning process currently underway in North Carolina. In addition to the case study, the various participation activities undertaken during preparation of the plan are described from state level advisory groups to local involvement in small area plans. The effectiveness of different methods of public participation during the stages of the planning process is compared. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-24892*# Business and Technological Systems, Inc., Seabrook, Md.

A CONCEPTUAL DESIGN FOR AN INTEGRATED DATA BASE MANAGEMENT SYSTEM FOR REMOTE SENSING DATA Final Report

Paul A. Maresca and R. Michael Lefler Sep. 1978 408 p refs

(Contract NAS5-24360)

(NASA-CR-159926; BTS-FR-78-65) Avail: NTIS HC A18/MF A01 CSCL 05B

The requirements of potential users were considered in the design of an integrated data base management system, developed to be independent of any specific computer or operating system, and to be used to support investigations in weather and climate. Ultimately, the system would expand to include data from the agriculture, hydrology, and related Earth resources disciplines. An overview of the system and its capabilities is presented. Aspects discussed cover the proposed interactive command language; the application program command language; storage and tabular data maintained by the regional data base management system; the handling of data files and the use of system standard formats; various control structures required to support the internal architecture of the system; and the actual system architecture with the various modules needed to implement the system. The concepts on which the relational data model is based; data integrity, consistency, and quality; and provisions for supporting concurrent access to data within the system are covered in the appendices. A.R.H.

N79-24893# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

EVALUATION OF COMPUTER AIDED INDEXING OF INFORMATION FOR SUPPORT OF CONTRACT APPEALS M.S. Thesis

Ronald D. Vargo Sep. 1978 98 p refs

(AD-A065835; AFIT/GSM/SM/78S-24) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Air Force Directorate of Contract Appeals (AFLC/JAB) has encountered difficulty in managing information needed in case preparation. Problems with manual information systems overload and lack of attorney time prevented adequate representation for the Air Force before the Armed Services Board of Contract Appeals. Also, the conduct of an effective litigation presentation was difficult. In order to remedy this situation several pilot computer-based systems had been developed, but they needed to be tested against the requirements of the Directorate. This thesis consists of a study of the requirements and evaluations of the costs and benefits of two feasible equipment configurations. To accomplish the evaluations, the expected costs of both configurations is compared to the personnel costs that would be required to achieve the needed capabilities without the use of computer-based systems. Both the use of time sharing systems and the use of a dedicated minicomputer are found to be cost effective, but the procurement of a minicomputer-based word processing system is expected to lead to greater overall savings. The conclusions offered also include a suggested plan for system implementation and recommendations for additional research that can be accomplished. Author (GRA)

N79-24894# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Computer Science and Applied Mathematics.

CARTOGRAPHIC BASE FILES AT LAWRENCE BERKELEY LABORTORY: 1978 INVENTORY

B. R. Burkhart Jan. 1979 58 p refs

(Contract W-7405-eng-45)

(LBL-8707) Avail: NTIS HC A04/MF A01

The cartographic base files for the display portion of Lawrence Berkeley Laboratory's Socio-Economic-Environmental-Demographic Information System thematic mapping program is described. Included are: contact person, abstract, original data source, availability, record contents, and a plot of each file. The files are in polygon format for use within the computer environment at LBL. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-24947# Joint Publications Research Service, Arlington, Va.

PRODUCTION, UTILIZATION OF COMPUTER TECHNOLOGY IN NATIONAL ECONOMY

V. Myasnikov, I. Korostelin, and Yu. Krasov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 1-12 Transl. into ENGLISH from Vestn. Statist. (Moscow), no. 1, Jan. 1979 p 39-48 (For primary document see N79-24946 15-99)

Copyright. Avail: NTIS HC A03/MF A01

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-24895 Clemson Univ., S.C.

SIMULATION AND CONTROL OF ADVANCED WASTEWATER TREATMENT SYSTEMS Ph.D. Thesis

Wayne Michael Kachel 1978 252 p

Avail: Univ. Microfilms Order No. 7909400

Increasingly stringent discharge requirements can, in many instances, only be satisfied by means of physiochemical wastewater treatment processes, utilized as tertiary add-on units or as the new generation independent physiochemical (IPC) treatment systems. An accurate mathematical model of a typical IPC system was developed and various control strategies are investigated. The proposed lime clarification model uses equilibrium chemistry to predict the resultant pH while accounting for decreases in alkalinity and total carbonate due to precipitate formation. Using an empirical correlation, the degree of suspended solids removal is predicted as a function of overflow rate. Dissert. Abstr.

N79-24896 Texas Univ. at Austin.

STOCHASTIC ANALYSIS OF A HIGH-RATE ACTIVATED SLUDGE WASTEWATER TREATMENT PLANT WITH RANDOM DIURNAL PLANT INPUTS AND RANDOM PROCESS PARAMETERS, VIA MONTE-CARLO SIMULATION Ph.D. Thesis

Wiwut Tanthapani Chakoon 1978 503 p

Avail: Univ. Microfilms Order No. 7911037

The treatment plant model consisted of a primary settler, an activated sludge aeration tank, and a final clarifier. Dynamic models that took account of the effect of mixing inside the process vessels were used for each of the three process units. A sensitivity analysis of the corresponding deterministic plant

model was carried out to identify the more important inputs and process parameters. Then, a stochastic analysis of the plant under various conditions was carried out via Monte Carlo simulation. The effect of input noise frequency and types of distribution on the stochastic characteristics of the outputs was also investigated. Examples of how to design a wastewater treatment plant were prepared, and methods of determining the overdesign factor needed for conventional engineering design explained. The validity of the propagation of variance formula, the ensemble variance of the outputs of a nonlinear stochastic model in the unsteady state, were demonstrated. Dissert. Abstr.

N79-24897 Southern Methodist Univ., Dallas, Tex.
MATHEMATICAL PROGRAMMING METHODS FOR URBAN TRANSPORTATION NETWORKS Ph.D. Thesis
Mustafa Fatih Sadek Abdulaal 1978 198 p
Avail: Univ. Microfilms Order No. 7911216

Optimization based methods which can be embedded in the general transportation planning process are addressed. Models and solution techniques for combined modal split-equilibrium assignment problems and transportation network design problems are developed. A brief review of the existing models and basic techniques that are generally used in the process of transportation planning is presented. Different ways of combining modal split models and equilibrium assignment models into one multimodal equilibrium assignment model with variable modal splits are discussed. Dissert. Abstr.

N79-24898# Transportation Systems Center, Cambridge, Mass.
SERVICE METHODS DEMONSTRATION PROGRAM Annual Report, Oct. 1976 - Sep. 1977
Don Kendall Jul. 1978 341 p refs
(PB-292008/0; DOT-TSC-UMTA-78-33; UMTA-MA-06-0049-78-6) Avail: NTIS HC A15/MF A01 CSCL 13B

The Urban Mass Transportation Administration's Service and Methods Demonstration Program addressed the national need to improve the quality, quantity, and efficiency of public transportation services of innovative transit oprating techniques and services which utilize existing technology. Program activities and accomplishments are reviewed, including current and future demonstration project descriptions, project findings, and other support activities. Project finding were organized into four program areas: conventional transit, pricing and service innovations, paratransit, and special user groups. Results of demonstration projects and studies leading to or in support of demonstrations were summarized. GRA

N79-24899# Argonne National Lab., Ill.
ENVIRONMENTAL DEVELOPMENT PLAN FOR TRANSPORTATION ENERGY CONSERVATION. FY 1979 UPDATE
M. K. Singh and M. J. Bernard, III 15 Dec. 1978 157 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-33) Avail: NTIS HC A08/MF A01

This first annual update of the Environment Development Plan (EDP) identifies the ecosystem, resource, physical environment, health, safety, and socioeconomic concerns associated with the division's transportation programs. These programs include the research, development, demonstration and assessment of seventeen transportation technologies and several strategy and policy development and implementation projects. The transportation technologies projects deal with highway transport including electric vehicles, marine transport and pipeline transport. This EDP presents a research and assessment plan for resolving any potentially adverse environmental concerns stemming from these programs. DOE

N79-24900# Department of Energy, Washington, D. C. Transportation Energy Conservation Div.
ELECTRIC AND HYBRID VEHICLE PROGRAM Annual Report to Congress, fiscal year 1978
Jan. 1979 90 p refs
(DOE/CS-0068; AR-2) Avail: NTIS HC A05/MF A01

The DOE Electric and Hybrid Vehicle Program has responsibility for accelerating the commercialization of electric and hybrid vehicles in the nation's transportation sector. The goal of the program is to assure the availability and broad market acceptance of vehicles that do not depend on petroleum as their principal energy source. The program management, demonstrations (P. L. 94-413 requirements), incentives, research and development, risk assessment, impact assessments, and environmental impact evaluation processes are discussed. DOE

N79-24901# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge- Entwicklung.
HUMAN FACTORS ENGINEERING RESEARCH FOR CABIN TAXI (CAT)
S. Streubel, K. Brauser, G. Immel, and K. Whistling 20 Sep. 1977 16 p In GERMAN; ENGLISH summary Presented at West European Assoc. for Aviation Psychol. Symp., Tegernsee, West Ger., 20 Sep. 1977
(MBB-UFE-1355-O) Avail: NTIS HC A02/MF A01

Research was undertaken in order to develop a new urban traffic system, 'Cabintaxi' (CAT), designed to optimize both passenger comfort and ease of utilization. Considerable emphasis is given to the effects of acceleration (g) and acceleration coefficients (g/sec). The way in which these parameters affected eight volunteer subjects (righthand and lefthand bends) was studied. Interactions between passengers and CAT were investigated together with traffic information and coordination problems. Author (ESA)

N79-24902# Oxford Univ. (England). Engineering Lab.
MINIMUM VARIANCE CONTROL, ESTIMATION AND SIMULATION OF NONLINEAR MODELS OF WASTEWATER TREATMENT SYSTEMS
C. J. Harris 1977 31 p refs
(OUEL-1214/77) Avail: NTIS HC A03/MF A01

A set of model equations for the activated sludge process was derived and shown to be nonlinear, Ito stochastic differential equations for which analytic solutions are not tractable. A first order simulation algorithm based on the properties of Ito calculus was used to validate the model equations and assess various control schemes. In particular, a minimum variance control law was investigated; the structure of the controller was selected a priori on the basis of ease of physical implementation and cost. The derived control is a state feedback law. Although the control of wastewater systems is highlighted, the techniques of simulation, minimum variance control, and state estimation introduced are of a very general applicability. Author (ESA)

N79-24903# Colorado State Univ., Fort Collins. Water Resources Research Inst.
DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES, PART 1 Completion Report
Eugene J. Riordan, Neil S. Grigg (N. Carolina Univ.), and Robert L. Hiller Sep. 1978 67 p refs Sponsored in part by Urban Drainage and Flood Control District, Denver; and City of Lakewood, Colo. 2 Vol.
(Contract DI-14-34-0001-7112; OWRT Proj. B-161-COLO(5)-Pt-1)
(PB-290997/6; COMPLETION-85-Pt-1; W79-04109) Avail: NTIS HC A04/MF A01 CSCL 13B

A drainage management procedure for mitigating community development-induced drainage impacts is presented. The three major elements of a drainage management program are discussed: (1) the technical element establishes the method of flood hydrology calculation; (2) the financial element establishes methods for drainage and flood control cost calculation and cost allocation; and (3) the regulatory element establishes the enforcement mechanism of the drainage management program. The planning methodology for calculating project costs can reduce the front-end drainage planning cost by 75 to 80%. GRA

N79-24904# Colorado State Univ., Fort Collins. Water Resources Research Inst.
DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES, PART 2 Completion Report
Eugene J. Riordan, Neil S. Grigg, and Robert L. Hiller Sep. 1978 227 p refs 2 Vol.
(Contract DI-14-34-0001-7112; OWRT Proj. B-161-COLO(5)-Pt-2)
(PB-290998/4; COMPLETION-86-Pt-2; W79-04110) Avail:

NTIS HC A11/MF A01 CSCL 13B

The three major elements of a drainage control program directed towards mitigating community development generated induced drainage impacts of a recommended drainage management program are discussed Various hydrologic predictions used to evaluate development-induced drainage impacts are examined. The predictive capability of some rain-fall-runoff models is compared through a statstical analysis of published results from those models, and the sensitivity of project analysis to poor runoff prediction is evaluated. The financial aspect of a drainage management system is developed through a review of the legal issues concerning municipal and developer liability cost calculation, and cost apportionment. GRA

N79-24905# Colorado State Univ., Fort Collins.
RESEARCH NEEDS FOR COMMUNITY WATER MANAGEMENT
Aug. 1978 99 p refs Sponsored by NSF
(PB-291938/9; NSF/RA-780370) Avail: NTIS HC A05/MF A01 CSCL 13B

The nature of problems to be resolved by community water management is discussed. Topics covered include: (1) the origin and character of the problems of community water systems and their relationships to research; (2) a review of the important problems and the institutions for planning and management of community water systems; and (3) research requirements related to the President's water policy message. GRA

N79-24906# CH2M/Hill, Inc., Gainesville, Fla.
REPORT TO CONGRESS ON CONTROL OF COMBINED SEWER OVERFLOW IN THE UNITED STATES Final Report
Ronald L. Wycoff, James E. School, and Michael J. Mara Washington EPA 1 Oct. 1978 226 p refs
(Contract EPA-68-01-3993)
(PB-291966/0; EPA-430/9-78-006; EPA/MCD-50) Avail: NTIS HC A11/MF A01 CSCL 13B

The status of awarded grants, requested grants, and the estimated time required to achieve required control of combined sewer overflow pollution are reported for each state. Discharges of pollutants from treated municipal effluent with combined sewer overflow are compared and alternative control technologies are analyzed. Legislative alternatives to control pollution from combined sewer overflow are presented. GRA

N79-24907# General Accounting Office, Washington, D. C. Community and Economic Development Div.
HAZARDOUS WASTE MANAGEMENT PROBLEMS WILL NOT BE EFFECTIVE: GREATER EFFORTS ARE NEEDED Report to the Congress
23 Jan. 1979 37 p refs
(PB-291622/9; CED-79-14) Avail: NTIS HC A03/MF A01 CSCL 13B

Topics discussed include the inadequacy of current State programs to assume responsibility for managing State hazardous waste programs mandated under the Resource Conservation and Recovery Act of 1976; and the need for additional resources (staff and funds) to effectively carry out the provisions of the Act. The Environmental Protection Agency is urged to encourage the establishment of fee systems for implementing and operating State hazardous waste programs. GRA

N79-24908# Exxon Research and Engineering Co., Linden, N. J.
STATE-OF-THE-ART STUDY OF LAND AND IMPOUNDMENT TECHNIQUES Final Report
Wilford S. Stewart Dec. 1978 88 p refs
(Grant EPA-R-803585)
(PB-291881/1; EPA-600/2-78-196) Avail: NTIS HC A05/MF A01 CSCL 11I

The results are presented of a literature search and state-of-the-art survey of liner materials utilized in impoundments sites for the containment of seven general types of industrial wastes. The objectives of the study were to assemble the avaliable information concerning the chemical and physical properties, cost, and field performance data of various liner materials. The data obtained from the literature search were supplemented with information obtained from various liner manufacturers, fabricators, suppliers, installers, consultants, and trade association representatives. In addition, the report contains an engineering analysis of the chemical compatibility of the liner materials with the industrial wastes of interest. From this analysis, preliminary recommendations are made concerning the suitability of the liner materials for containing the specified industrial wastes. GRA

N79-24909# Maryland Univ., College Park. Transportation Studies Center.
GUIDES FOR UNDERTAKING A NEIGHBORHOOD TRANSPORTATION NEEDS ASSESSMENT: USERS MANUAL Final Report, Jun. 1977 - Nov. 1978
Thomas E. Mulinazzi, J. Aubrey Smailes, and Robert L. Bish Nov. 1978 124 p refs
(PB-290589/1; UMTA-MD-11-0003-79-1) Avail: NTIS HC A06/MF A01 CSCL 13B

The Manual provides instructions, information, sources, and guidelines which may be used by neighborhood organizations to undertake analysis of transportation problems in their area. The main body of this report is subdivided into the three major areas into which most neighborhood related transportation problems fall--transit projects, parking projects, and traffic projects. Typical problems, and suggested format to solve the problems are contained in each of these three sections. Based on a literature review, results from a national questionnaire, and two case studies in neighborhoods (Baltimore and Pittsburgh) the report concludes that the problems discussed in this Manual appear to be the major transportation problems now affecting the neighborhoods in the United States. GRA

N79-24910# Maryland Univ., College Park.
URBAN TRANSPORTATION AND NEIGHBORHOOD PRESERVATION Final Report, Aug. 1977 - Sep. 1978
Robert L. Bish, Beth VanDongen, Christopher F. Weichert, J. Aubrey Smailes, and Thomas E. Mulinazzi Sep. 1978 26 p refs Sponsored by DOT
(PB-290590/9; UMTA-MD-11-0003-79-2) Avail: NTIS HC A03/MF A01 CSCL 13B

General literature on transportation and the history of cities and transportation studies of neighborhoods in Baltimore and Pittsburgh which are typical of those with stabilization and preservation programs were analyzed to determine the relationship between urban transportation and the preservation of older neighborhoods. Neighborhood-oriented organizations, including community groups, church organizations, senior citizens and social clubs were also surveyed nationally regarding transportation related problems and their identification and resolution. Major problems identified herein are: streets in poor repair, insufficient parking; excessive through traffic; a lack of transportation for the elderly and those without automobiles. GRA

N79-24911# Environmental Protection Agency, Washington, D. C. Office of Air, Land and Water Use.
PROCEEDINGS OF THE STORMWATER MANAGEMENT MODEL (SWMM) USER'S GROUP MEETING Final Report
Harry C. Torno, ed. Nov. 1978 244 p refs Meeting held at Annapolis, Md., 13-14 Nov. 1978
(PB-290742/6; EPA-600/9-79-003) Avail: NTIS HC A11/MF A01 CSCL 13B

Various model related topics include a description of the new SWMM storage/treatment program, storm-water retention, a methodology for evaluating agricultural best management practices, model applications in facility planning, and other model applications. GRA

N79-24912# Environmental Protection Agency, Washington, D. C.
OFFICE OF RESEARCH AND DEVELOPMENT PROGRAM GUIDE, FISCAL YEAR 1979 Report, 1 Oct. 1978 - 30 Sep. 1979
Jan. 1979 84 p refs Prepared by JRB Associates, McLean, Va.
(Contract EPA-68-01-4839)
(PB-292003/1; EPA-600/9-79-002) Avail: NTIS HC A05/MF A01 CSCL 13B

The Program Guide provides the public with information on the Office of Research and Development's current extramural research program. It describes each of the major budget units,

the funds associated with each, and the responsible laboratory (ies). In addition there are several indices which allow the user to refer to these units by media (air, water, etc.) function (health effects, control technology, etc.), or by a given laboratory's areas of responsibilities. GRA

N79-24913# National Oceanic and Atmospheric Administration, Washington, D. C.
REPORT TO THE CONGRESS ON OCEAN DUMPING RESEARCH Annual Report, Jan. - Dec. 1977
Aug. 1978 30 p
(PB-292791/1; NOAA-79021401; AR-5) Avail: NTIS HC A03/MF A01 CSCL 13B

The investigation focuses upon three major categories of pollutant materials: sewage sludge, industrial wastes, and dredged materials. Field and laboratory studies relating to these types of pollutants were completed during the year that apply to several marine areas. The effects of dumping industrial wastes into deep waters was investigated for a disposal site in the Gulf of Mexico and for a site in the Atlantic near New Jersey. The environmental effects of sewage sludge and dredged material disposal were studied in the region of the New York Bight. GRA

N79-24914# West Virginia Univ., Morgantown.
A RECYCLED-WATER SANITARY WASTE DISPOSAL SYSTEM Ph.D. Thesis
William Joseph Shoupp 1978 127 p refs
(Contract DI-14-34-0001-7104)
(PB-291740/9; W79-03034; OWRT-A-034-WVA(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

A closed, recycled-water sanitary-waste-disposal system for laboratory study was developed. The system was based on a 1,000-liter capacity, water-filled biodegradation tank. Two specific environmental variables were studied: organic-loading rate of an artificial waste material, based on ground dog-food into the system, and aeration rates imposed on the water column. Two loading rates and two aeration rates were imposed on the experimental system. Sampling of the tank was carried out on a weekly schedule by sample withdrawal from ports penetrating the tank walls. Data were collected and analyzed for the following biological and chemical parameters: total aerobic and anaerobic standard plate counts, ATP content, total carbon, inorganic carbon, organic carbon, pH, and dissolved oxygen. In addition, the predominant bacterial genera present during the stationary stages of the experimental runs were isolated and identified. GRA

88 SPACE SCIENCES (GENERAL)

N79-24915*# Science Applications, Inc., Schaumburg, Ill.
ADVANCED PLANETARY STUDIES Annual Report
Dec. 1978 100 p refs
(Contract NASw-3035)
(NASA-CR-158657; SAI-1-120-839-A5; AR-5) Avail: NTIS HC A05/MF A01 CSCL 03B

Eleven study tasks are described and key results are discussed for the following: advanced planning activity; cost estimation research; planetary missions performance handbooks-revisions; multiple discipline science assessment; asteroid workshop; galilean lander mission strategies; asteroid exploration study; ion drive transport capabilities; Mars strategy study; Venus surface sample return; and ion drive/solar sail assessment study. A.R.H.

N79-24916*# Science Applications, Inc., Schaumburg, Ill.
MULTIPLE DISCIPLINE SCIENCE ASSESSMENT
William C. Wells Dec. 1978 87 p refs
(Contract NASw-3035)
(NASA-CR-158656; SAI-1-120-839-S4) Avail: NTIS HC A05/MF A01 CSCL 03B

Various science disciplines were examined to determine where and when it is appropriate to include their objectives in the planning of planetary missions. The disciplines considered are solar astronomy, stellar and galactic astronomy, solar physics, cosmology and gravitational physics, the geosciences and the applied sciences. For each discipline, science objectives are identified which could provide a multiple discipline opportunity utilizing either a single spacecraft or two spacecraft delivered by a single launch vehicle. Opportunities using a common engineering system are also considered. The most promising opportunities identified include observations of solar images and relativistic effects using the Mercury orbiter; collection of samples exposed to solar radiation using the Mars surface sample return; studies of interstellar neutral H and He, magnetic fields, cosmic rays, and solar physics during Pluto or Neptune flybys; using the Mars orbiter to obtain solar images from 0.2 AU synchronous or from 90 deg orbit; and the study of the structure and composition of the atmosphere using atmospheric probes and remotely piloted vehicles. A.R.H.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-24917 Cornell Univ., Ithaca, N. Y.
PULSAR TIMING RESULTS FROM ARECIBO OBSERVATORY Ph.D. Thesis
Gordon Edward Gullahorn 1978 163 p
Avail: Univ. Microfilms Order No. 7910808

The observing programs and data analysis methods used at Arecibo Observatory are reviewed and the resultant parameters are tabulated. The behavior of the phase residuals is discussed with emphasis on a few pulsars with comparatively large residuals seeming to have no correlation on time scales of a day or more. Examples of 'wandering' behavior are also shown. A number of apparent sudden changes in the frequency are presented. The behavior of the frequency derivative exhibited two unpredicted effects: a sharp discontinuity for the Crab nebula pulsar, and several frequency second derivatives much larger than is compatible with normal braking mechanisms. These are interpreted as changes in the braking torque on the pulsars and mechanisms for this are suggested. In particular, the second derivatives appear explicable in terms of interaction with density fluctuations in the interstellar medium. Dissert. Abstr.

N79-24918 Texas Univ. at Austin.
A MAGNETIC STUDY OF THE SPOTTED UV CETI FLARE STARS AND RELATED LATE-TYPE DWARFS Ph.D. Thesis
Steven Scott Vogt 1978 282 p
Avail: Univ. Microfilms Order No. 7911045

Design and construction of a multichannel photoelectric Zeeman analyzer built to investigate the magnetic nature of the spotted UV Ceti flare stars is presented. Performance and sensitivity of the instrument is demonstrated by observations of HD 153882 and Beta Cor Bor, two well-known magnetic stars. The system was then applied to a sample of 19 program objects, of which 5 were currently spotted dKe and dMe stars, 7 were normal dK and dM stars, and 7 were UV Ceti flare stars. Contrary to most previously published observations and theoretical expectations, no magnetic fields were detected on any of these objects from either the absorption lines or the H alpha emission line down to an observational uncertainty level of 100 to 160 Gauss. Dissert. Abstr.

N79-24919*# General Electric Co., Schenectady, N. Y.
DESIGN, FABRICATION, AND DELIVERY OF A CHARGE INJECTION DEVICE AS A STELLAR TRACKING DEVICE Final Technical Report, 28 Nov. 1977 - 28 Nov. 1978
H. K. Burke, G. J. Michon, H. W. Tomlinson, T. L. Vogelsong, A. Grafinger, and R. Wilson Apr. 1979 68 p refs
(Contract NAS8-32801)
(NASA-CR-161226; SRD-78-171) Avail: NTIS HC A04/MF A01 CSCL 03A

Six 128 x 128 CID imagers fabricated on bulk silicon and with thin polysilicon upper-level electrodes were tested in a star tracking mode. Noise and spectral response were measured as a function of temperature over the range of +25 C to -40 C. Noise at 0 C and below was less than 40 rms carriers/pixel for all devices at an effective noise bandwidth of 150 Hz. Quantum yield for all devices averaged 40% from 0.4 to 1.0 microns with no measurable temperature dependence. Extrapolating from

these performance parameters to those of a large (400 x 400) array and accounting for design and processing improvements, indicates that the larger array would show a further improvement in noise performance -- on the order of 25 carriers. A preliminary evaluation of the projected performance of the 400 x 400 array and a representative set of star sensor requirements indicates that the CID has excellent potential as a stellar tracking device. Author

N79-24920*# National Aeronautics and Space Administration, Washington, D. C.
HELIOSTAT FOR ASTRONOMICAL USAGE
Gustav Heyde May 1979 7 p Transl. into ENGLISH from German Patent no. 326516, 16 Dec. 1919 2 p Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75481) Avail: NTIS HC A02/MF A01 CSCL 03A

The design of a heliostat is presented. The invention consists of a mechanical polar axis which can rotate and which is parallel to the world axis. A mirror is supported in such a way that it can be rotated arbitrarily around a declination axis which is perpendicular to it. After execution of this rotation, the mirror can be clamped in the plane of the world axis, which can be corrected and verified by special collimation directions. The clockwork or drive unit can be driven for a 24 or 48 hour complete rotation of the axis using any known device such as switchable gears, without changing its regular variation related to stellar time or mean solar time. G.Y.

N79-24921*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COLLISIONLESS GALAXY SIMULATIONS
Frank Hohl, Thomas A. Zang (Coll. of William and Mary, Williamsburg, Va.), and John B. Miller (Old Dominion Univ.) Apr. 1979 149 p refs
(NASA-RP-1037; L-12730) Avail: NTIS HC A07/MF A01 CSCL 03A

Three-dimensional fully self-consistent computer models were used to determine the evolution of galaxies consisting of 100 000 simulation stars. Comparison of two-dimensional simulations with three-dimensional simulations showed only a very slight stabilizing effect due to the additional degree of freedom. The addition of a fully self-consistent, nonrotating, exponential core/halo component resulted in considerable stabilization. A second series of computer experiments was performed to determine the collapse and relaxation of initially spherical, uniform density and uniform velocity dispersion stellar systems. The evolution of the system was followed for various amounts of angular momentum in solid body rotation. For initally low values of the angular momentum satisfying the Ostriker-Peebles stability criterion, the systems quickly relax to an axisymmetric shape and resemble elliptical galaxies in appearance. For larger values of the initial angular momentum bars develop and the systems undergo a much more drastic evolution. L.S.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-24922 Indiana Univ., Bloomington.
AN INVESTIGATION OF THE INTERGALACTIC MEDIUM VIA THE 21 cm LINE OF NEUTRAL HYDROGEN Ph.D. Thesis
Martha Patricia Haynes 1978 257 p
Avail: Univ. Microfilms Order No. 7909689

In rich clusters of galaxies, the intracluster medium is likely to consist of high temperature gas. Comparison of the neutral hydrogen content of galaxies which are within rich clusters with that of isolated galaxies examines the hypothesis that continuing hydrodynamic interaction of the interstellar gas within the galaxies with the intracluster medium sweeps gas out of the galaxies. In some spiral-poor clusters, the galaxies do seem to show a lower hydrogen mass to luminosity ratio than do the isolated galaxies; however, not all galaxies in clusters are hydrogen deficient. There is no evidence for any neutral component of the intracluster medium within rich clusters. Dissert. Abstr.

N79-24923 Texas Univ. at Austin.
A PHOTOMETRIC AND KINEMATIC STUDY OF THE BARRED SPIRAL GALAXY NGC 253 Ph.D. Thesis
William David Pence 1978 160 p
Avail: Univ. Microfilms Order No. 7911009

Detailed isosphotometry of NGC 253 in the Sculptor Group in blue light to a limiting surface brightness of 29 magnitudes per square second was obtained from a combination of photographic and photoelectric photometry. The standard photometric parameters were derived. The absolute luminosity of NGC 253, corrected for galactic and internal extinction is L sub T = 2.65 x 10 to the 10th power L circle dot. A three component luminosity model of NGC 253 is derived consisting of a r to the 1/4th power spheroid, an exponential disk and a spiral arm component which contribute, respectively, 15, 59, and 26 percent of the total B luminosity. A detailed velocity map was derived from 9,842 individual radial velocity measurements on 25 H alpha interferograms convering the entire bright disk. A total mass is estimated and noncircular motions, in excess of 50 km/s, are observed in several areas. Dissert. Abstr.

N79-24924 Texas Univ. at Austin.
A STUDY OF MOLECULAR CLOUDS NEAR SUPERNOVA REMNANTS Ph.D. Thesis
Henry Alwyn Wootten 1978 257 p
Avail: Univ. Microfilms Order No. 7911051

Various properties of the structure and kinematics of the clouds are used to establish their physical association with well-known remnants. An infrared survey of the most massive clouds revealed embedded objects, probably stars whose formation was induced by the supernova blast wave. In order to understand the relationship between these and other molecular clouds a control group of clouds was also observed. Excitation models for dense regions of all the clouds are constructed to evaluate molecular abundances in these regions. Those clouds which have embedded stars have lower molecular abundances than the clouds which do not. A cloud near the W28 supernova remnant also has low abundances. Molecular abundances are used to measure an important parameter, the electron density. Dissert. Abstr.

N79-24925*# Texas Univ. at Austin. Dept. of Astronomy.
ORBITAL THEORIES OF OUTER PLANET SATELLITES Final Technical Report, 1 Dec. 1977 - 31 May 1979
William H. Jefferys Jun. 1979 23 p refs
(Grant NsG-7408)
(NASA-CR-158667) Avail: NTIS HC A02/MF A01 CSCL 03B

An analytical theory of Mimas and Tethys was developed, retaining terms which produce perturbations of the order of + or - 10 km. The theory uses a novel set of variables, and was developed with the Hori-Lie algorithm, using the algebraic manipulation language TRIGMAN. the perturbations were implemented by means of FORTRAN subroutines produced by the computer. G.Y.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N79-24926 California Inst. of Tech., Pasadena.
BAROTROPIC AND BAROCLINIC INSTABILITIES IN JUPITER'S ZONAL FLOW Ph.D. Thesis
David Pollard 1978 166 p
Avail: Univ. Microfilms Order No. 791163

The barotropic and baroclinic stability of Jupiter's zonal jets is investigated using a two-layer quasi-geostrophic model. Each

layer is of constant density, with the upper layer representing the cloudy levels of Jupiter's atmosphere above approximately 5 bars containing the zonal jets u bar(y), and a much deeper lower layer in which u bar = 0. Since Jupiter's vertical structure associated with the zonal jets is unknown at these levels, this model attempts to include the effects of baroclinicity and deep lower layer inertia with as few free vertical-structure parameters as possible, (i.e., the upper layer Rossby radius of deformation L sub r and the ratio of the upper layer to lower layer thickness delta). Dissert. Abstr.

N79-24927 California Inst. of Tech., Pasadena.
STUDIES OF CALCIUM ISOTOPE FRACTIONATION FOUND IN NATURE AND PRODUCED DURING ION SPUTTERING Ph.D. Thesis
William A. Russell 1979 279 p
Avail: Univ. Microfilms Order No. 7911634

High precision analytical techniques were developed for the measurement of calcium isotopic abundances in samples as small as 2 x10 to the -9th power mole. Typical relative uncertainties for measurement of calcium isotope abundance ratios are 1-4 x 10 to the -4th power and isotopic differences between samples arising from mass fractionation can be resolved to 1 x 10 to the -4th power per unit mass difference. Variation of Ca isotope compositions in the solar system were studied through analysis of meteorites, lunar samples, and terrestrial samples. Terrestrial, lunar, and meteoritic Ca isotopic fractionation ranges overlap and are about 2.50/00 for Ca-40/Ca-44. Measurements were carried out for Ca leached with water from a lunar soil. The sputtering experiments roughly simulate the solar wind conditions in terms of the beam energy per mass unit and in terms of the sputtering yields. The large effects indicate the likelihood that fractionation intrinsic to sputtering was a major mechanism contributing to the lunar soil isotopic fractionation.
Dissert. Abstr.

N79-24928 California Univ., Riverside.
DISSIPATION OF TEMPERATURE PERTURBATIONS IN A PLANETARY ATMOSPHERE BY RADIATIVE TRANSFER Ph.D. Thesis
Carlos Gay 1978 350 p
Avail: Univ. Microfilms Order No. 7911441

A proper theoretical treatment of radiative relaxation of temperature perturbations in a planetary atmosphere constitutes an eigenvalue problem. The solutions constitute an orthogonal set under rather broad conditions and correspond to elementary perturbations, each one decaying in time at a constant rate. A method of solution was derived which can accommodate arbitrary atmospheric transmission characteristics. The eigenvalue character of the relaxation problem introduces two limiting values for the time of decay. The relaxation of a stratospheric warming event was studied by expanding the perturbed temperature profile in terms of the orthogonal eigenfunctions appropriate to the stratosphere. It is found that radiation is the most important dissipative mechanism in its decaying phase. It is also shown that steady-state solutions can be obtained in terms of the same eigenfunctions. Dissert. Abstr.

N79-24929*# Martin Marietta Labs., Baltimore, Md.
PETROGRAPHIC AND PETROLOGICAL STUDIES OF LUNAR ROCKS Final Report, 5 May 1977 - 4 Feb. 1978
Stephen R. Winzer Feb. 1978 59 p refs
(Contract NAS5-24163)
(NASA-CR-159921; MML-TR-78-11c) Avail: NTIS HC A04/MF A01 CSCL 03B

Clasts, rind glass, matrix glass, and matrix minerals from five Apollo 15 glass-coated breccias (15255, 15286, 15465, 15466, and 15505) were studied optically and with the SEM/microprobe. Rind glass compositions differ from sample to sample, but are identical, or nearly so, to the local soil, suggesting their origin by fusion of that soil. Most breccia samples contain green or colorless glass spheres identical to the Apollo 15 green glasses. These glasses, along with other glass shards and fragments, indicate a large soil component is present in the breccias. Clast populations include basalts and gabbros containing phases highly enriched in iron, indicative of extreme differentiation or fractional crystallization. Impact melts, anorthosites, minor amounts of ANT suite material are also present among the clasts. Tektite glasses, impact melts, and breccias from the Zhamanshin structure, USSR, were also studied. Basic tektite glasses have been found to be identical in composition to impact melts from the structure, but no satisfactory parent material has been identified in the limited suite of samples available. L.S.

N79-24930*# Texas Univ. at Austin. Dept. of Astronomy.
LUNAR LASER RANGING DATA IDENTIFICATION AND MANAGEMENT Semiannual Status Report, 1 Sep. 1978 - 28 Feb. 1979
Mar. 1979 8 p
(Grant NsG-7162)
(NASA-CR-158649; SASR-17) Avail: NTIS HC A02/MF A01 CSCL 03B

Activity under the subject grant during the first half of fiscal year 1979 at the University of Texas at Austin is reported. Raw lunar laser ranging data submitted by McDonald Observatory, Fort Davis, Texas and by the Australian Division of National Mapping at Orroral Valley, Australia were processed. This processing includes the filtering of signal events from noise photons, normal point formation, data archive management, and data distribution. System-wide program maintenance and up-grade carried out wherever and whenever necessary. Lunar laser ranging data is being transmitted from Austin to Paris for the extraction of earth rotation information during the EROLD campaign.A.R.H.

N79-24931*# Texas Univ. at Austin.
LUNAR LASER RANGING DATA DEPOSITED IN THE NATIONAL SPACE SCIENCE DATA CENTER NORMAL POINTS, FILTERED OBSERVATIONS, AND UNFILTERED PHOTON DETECTIONS Technical Report, 1 Jul. - 31 Dec. 1978
Peter J. Shelus Apr. 1979 12 p refs
(Grant NsG-7162)
(NASA-CR-158648) Avail: NTIS HC A02/MF A01 CSCL 03B

The lunar laser ranging project at McDonald Observatory provides the unique opportunity to acquire successfully precise range data for the earth-moon system. From the experiment's inception, the obligation was recognized to make these data available to the general scientific community in a reasonably useable form and in a realistic time frame. The documentation to be used in conjunction with the 1979 April deposit into the National Space Science Data Center which contains normal points, filtered observations and unfiltered photon stops for the months July through December, 1978 are reported. G.Y.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-24932*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF TIME DEPENDENT PHENOMENA OBSERVED WITH THE LPSP OSO-8 INSTRUMENT Final Report
John W. Leibacher Feb. 1979 135 p refs
(Contract NAS8-32356)
(NASA-CR-161233) Avail: NTIS HC A07/MF A01 CSCL 03B

The dynamics of the solar photosphere and chromosphere are studied. Observations obtained by the Laboratorie de Physique Stellaire et planetaire's (LPSP) ultraviolet spectrometer onboard the OSO-8 spacecraft are analyzed, and dynamic models of the chromosphere and the emitted resonance line spectrum are calculated. Some of the unpublished data analysis and theoretical modeling which are being prepared for publication are discussed. A discussion of the state of the theory of velocity fields in the solar atmosphere is also presented. An invited review presented at the OSO-8 Workshop on the topic of oscillatory motions in the quiet sun is included. The results of the OSO-8 data analysis prepared in close collaboration with LPSP scientists are presented. Material for two articles is also presented. G.Y.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-24933 California Univ., Riverside.
LOCALIZED SOURCES OF GAMMA RAYS OF 3 TO 25 MeV Ph.D. Thesis
Robert Brown Wilson 1978 144 p
Avail: Univ. Microfilms Order No. 7911764

Gamma rays from the region of the galactic anticenter were measured using a double Compton scatter gamma ray telescope flown on a balloon to 3.0 g/sq cm residual atmosphere. Measurements suggest a narrow energy interval, perhaps an O-16 6.1 MeV nuclear transition line, in which the flux is above the level predicted by extrapolation of the power law into the 5-10 MeV interval from lower and higher energies. Upper limits for a number of possible point sources in the energy interval of 3-25 MeV are given with the 2 sigma limit for NGC 4151 of 6.1 x 10 to the -3 power photons (sq cm/sec). The intensity of the pulsed emission from the Crab Pulsar, NP0532, is 4.3 plus or minus 2.6 x 10 to the minus 4 power photons (sq cm/sec) at 3-30 MeV consistent with results of other observations. An upper limit is placed on pulsed emission from AO535+26 and CG195+5 for periods from 102-106 sec and 57-60 sec, respectively. Dissert. Abstr.

N79-24934*# National Aeronautics and Space Administration, Washington, D. C.
FLUCTUATIONS IN MICROWAVE BACKGROUND RADIATION DUE TO SECONDARY IONIZATION OF THE INTERGALACTIC GAS IN THE UNIVERSE
R. A. Sunyayev May 1979 18 p refs Transl. into ENGLISH from Russian report Pr-349, 1977 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences USSR, Moscow
(NASA-TM-75619) Avail: NTIS HC A02/MF A01 CSCL 03B

Secondary heating and ionization of the intergalactic gas at redshifts z approximately 10-30 could lead to the large optical depth of the Universe for Thomson scattering and could smooth the primordial fluctuations formed at z approximately 1500. It is shown that the gas motions connected with the large scale density perturbations at z approximately 10-15 must lead to the generation of secondary fluctuations of microwave background. The contribution of the rich clusters of galaxies and young galaxies to the fluctuations of microwave background is also estimated.
Author

N79-24935*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COMPOSITIONS OF ENERGETIC PARTICLE POPULATIONS IN INTERPLANETARY SPACE
George Gloeckler [1979] 19 p refs
(Grants NGR-21-002-224; NGR-21-002-316)
(NASA-CR-158621; Preprint-79-158) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of helium and heavier particles with energies below about 10 to 20 MeV/nucleon are discussed with emphasis on the composition of solar flare particles, corotating energetic particle streams, and the anomalous cosmic ray component. Future advances expected from results obtained from ISEE -3, Voyager, and the international solar polar spacecraft are reviewed. A.R.H.

N79-24936# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
[RESEARCH ACTIVITIES OF THE INSTITUTE OF EXTRATERRESTRIAL PHYSICS]Annual Report, 1977 [TAETIGKEITSBERICHT 1977]
1977 229 p refs In GERMAN
(MPI-PAE-Extraterr-141) Avail: NTIS HC A11/MF A01

Active and passive experiments were carried out on plasma and particle phenomena in near and interplanetary space. Visible, infrared, X-ray, and cosmic radiation data obtained from satellites, balloons, and rockets were used. The ionosphere, magnetosphere, and solar wind were subjects of particular attention. Experimental techniques and equipment were developed, as were theoretical methods. Author (ESA)

99 GENERAL

N79-24937# Danish Academy of Technical Sciences, Copenhagen.
SPACE RESEARCH IN DENMARK
1978 14 p Presented at 21st COSPAR Plenary Meeting, Innsbruck, May-Jun. 1978
Avail: NTIS HC A02/MF A01

Activities of institutes doing basic and applied space research in Denmark are reviewed briefly. Work done on cosmic rays, plasma physics, ionosphere and magnetosphere studies, geodetic measurements, rocket measurements, microwave systems, astronomic programs, etc. is mentioned. Author (ESA)

N79-24938# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 625
20 Apr. 1979 39 p refs Transl. into ENGLISH from various Eastern European journals
(JPRS-73266) Avail: NTIS HC A03/MF A01

Czechoslovakian instruments and experiments carried on the Soyuz-28 Salyut mission are described as well as industrial applications of nuclear physics in Albania, and electron beam welding of aircraft turbine engines in Poland. For individual titles, see N79-24939 through N79-24940.

N79-24939# Joint Publications Research Service, Arlington, Va.
EXPERIMENTS OF USSR-CSSR COSMIC FLIGHT DESCRIBED c02
Michal Strida *In its* Transl. on Eastern Europe: Sci. Affairs, No. 625 (JPRS-73266) 20 Apr. 1979 p 1-5 Transl. into ENGLISH from Rude Pravo (Prague), 7 Mar. 1979 p 4 (For primary document see N79-24938 15-99)
Avail: NTIS HC A03/MF A01

The experiments proposed by Czechoslovakian scientists for the Souyz 28 mission and conducted jointly with the crew of the Salyut space station were successful and are producing the first results. Some of the instruments are now standard equipment for Salyut 6 and will be used in other space laboratories. Topics discussed include a photoelectric photometer for scanning and accurately tracking a setting star; the preparation and growth of crystals from mercury-bromide and mercury-dibromide melts; an oximeter to measure the effects of weightlessness on the oxygen saturation of arterial blood in the skin of astronauts' hands; an electrical dynamic katathermometer (cooling thermometer) which simultaneously records the cooling effects of the environment, the effect of radiant heat sources, and the human organism's response to changes in skin temperature; a questionnaire to record consmonauts' mental state before takeoff, during flight, and after the mission; and an investigation of genetic trait changes in chordella resulting from growth in weightless conditions.
A.R.H.

N79-24940# Joint Publications Research Service, Arlington, Va.
APPLICATION OF ELECTRON-BEAM WELDING TO AVIATION PRODUCTION c01
Henryk Zatyka *In its* Transl. on Eastern Europe: Sci. Affairs, No. 625 (JPRS-73266) 20 Apr. 1979 p 22-36 refs Transl. into ENGLISH from Tekhn. Lotniczna i Astronautyczna (Warsaw), no. 1, Jan. 1979 p 29-33 (For primary document see N79-24938 15-99)
Avail: NTIS HC A03/MF A01

An electron beam furnace used in the serial production of small turbines and turbocompressors for nonaviation production in Poland, was modified to melt the metal required for welding aircraft turbines engine parts. Technical parameters of the welding

process were established and instrumentation to insure high output was developed and executed. Metallurgical and strength tests were conducted on welded joints and conditions for welding a turbine were established which would insure a weld without faults, and of the required strength. Five turbine disks were welded, and after further mechanical working, were subjected to long term tests (2,000 hours). A.R.H.

N79-24941# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 66

30 Apr. 1979 61 p refs Transl. into ENGLISH from various Russian journals

(JPRS-73337) Copyright. Avail: NTIS HC A04/MF A01

Research in the areas of electronics and electrical engineering and nuclear physics is reported. Specific topics covered include: microprocessors, bipolar memory cells, Tokamak physics, and channeling of charged particles. For individual titles, see N79-24942 through N79-24945.

N79-24942# Joint Publications Research Service, Arlington, Va.

MICROPROCESSORS AND LSI MICROPROCESSOR SETS AS THE COMPONENT BASE OF MODERN DIGITAL SYSTEMS **c60**

M. K. Bushuyev, A. A. Galitsyn, and I. I. Shagurin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 1-17 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radioelektron. (Kiev), vol. 21, no. 12, 1978 p 18-28 (For primary document see N79-24941 15-99)

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Microprocessors and LSI microprocessor sets for the design of different classes of digital computer systems are described. A classification of microprocessors and microprocessor sets is given, and the specific architectural and structural features of each class are defined. The component base for the design of different classes of microprocessors is analyzed and their typical structures are given. J.M.S.

N79-24943# Joint Publications Research Service, Arlington, Va.

BIPOLAR DYNAMIC MEMORY CELLS **c60**

A. S. Berezin, V. A. Lapshinskiy, and Ye. M. Onishchenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 3 Apr. 1979 p 18-30 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radioelektron. (Kiev), vol. 21, no. 12, 1978 p 29-36 (For primary document see N79-24941 15-99)

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The state of the art in the field of bipolar dynamic memory cells and subsystems designed around them is treated. It is shown that injection dynamic cells are the most promising elements of this type. These cells are compared with dynamic cells designed around MOS transistors. Production technology variants for injection type dynamic memory cells are analyzed, and their parameters and prospects for development of very large scale immediate-access memory circuits are assessed. J.M.S.

N79-24944# Joint Publications Research Service, Arlington, Va.

TOKAMAK PHYSICS: THE 70TH BIRTHDAY OF L. A. ARTSIMOVICH (25 FEBRUARY 1909 TO 1 MARCH 1973) **c75**

B. B. Kadomtsev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 31-41 ref Transl. into ENGLISH from Priroda (Moscow), no. 2, Feb. 1979 p 21-27 (For primary document see N79-24941 15-99)

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Plasma physics and controlled nuclear fusion are discussed in relation to the development of the Tokamak device. Stable confinement of a high temperature plasma within the Tokamak in order to create conditions necessary for controlled nuclear fusion is emphasized. J.M.S.

N79-24945# Joint Publications Research Service, Arlington, Va.

CHANNELING OF CHARGED PARTICLES **c72**

A. F. Tulinov and N. G. Chechenin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 66 (JPRS-73337) 30 Apr. 1979 p 42-58 refs Transl. into ENGLISH from Priroda (Moscow), no. 2, Feb. 1979 p 2-12 (For primary document see N79-24941 15-99)

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The physics of the interaction of fast charged particles with single crystals is examined. Application of the backscattering method to various problems is discussed. In particular, the backscattering method is used to study the composition and structure of the surface of single crystals, to study volumetric properties of a crystal, and to determine the position of the impurity atoms in the crystal cell (microdistribution). J.M.S.

N79-24946# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 67

7 May 1979 42 p Transl. into ENGLISH from various Russian journals

(JPRS-73388) Copyright. Avail: NTIS HC A03/MF A01

News releases from the Soviet Union are presented. Topics include better utilization of data processing centers and automated control systems, as well as improved efficiency in producing electricity. For individual titles, see N79-24947 through N79-24949.

N79-24947# Joint Publications Research Service, Arlington, Va.

PRODUCTION, UTILIZATION OF COMPUTER TECHNOLOGY IN NATIONAL ECONOMY **c83**

V. Myasnikov, I. Korostelin, and Yu. Krasov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 1-12 Transl. into ENGLISH from Vestn. Statist. (Moscow), no. 1, Jan. 1979 p 39-48 (For primary document see N79-24946 15-99)

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The increased use and capabilities of information processing centers are reviewed. The use of computer equipment to increase labor productivity in the Soviet Union is discussed, as well as computer processing for scientific studies and production control. J.A.M.

N79-24948# Joint Publications Research Service, Arlington, Va.

RESEARCH SHOWS WAYS TO FACILITATE INTRODUCTION OF ASU'S **c63**

I. Zhezhko and A. Krivtsov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 13-18 Transl. into ENGLISH from Materialno-Tekhn. Snabzheniye (Moscow), no. 11, 1978 p 87-89 (For primary document see N79-24946 15-99)

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The socio-economic prerequisites for raising the efficiency of the automated control systems were considered. The conditions of use, actual work volume, and actual effectiveness of the automated systems were examined. J.A.M.

N79-24949# Joint Publications Research Service, Arlington, Va.

POWER INDUSTRY APPLICATION OF MHD TECHNOLOGY **c75**

A. Sheyndlin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 67 (JPRS-73388) 7 May 1979 p 19-22 Transl. into ENGLISH from Izvestiya (Moscow), 30 Mar. 1979 p 3 (For primary document see N79-24946 15-99)

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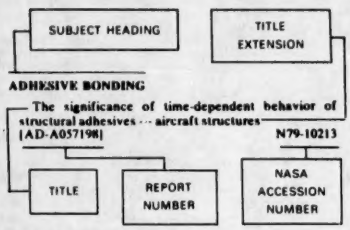
Various economic developments in the Soviet Union are discussed, concerning the increased requirements and production of electricity. The main concern is better utilization of available fuels, such as natural gas, crude oil, nuclear energy, etc. J.A.M.

SUBJECT INDEX

Typical Subject Index Listing



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A

ABRASION
Mechanisms of rubber abrasion
N79-24151

ABSORPTION
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158

ABSORPTIVITY
Continuum absorption coefficient of atoms and ions
[NASA-CR-158536] N79-24791

ABUNDANCE
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935

ACCELERATION [PHYSICS]
The acceleration and braking capability of hydrostatic transmissions
[BLL-RTS-11821] N79-24348
Acceleration sensitivity compensation in high performance crystal oscillators
N79-24735

ACETYLENE
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames
[AD-A066083] N79-24100

ACID BASE EQUILIBRIUM
Acid-base homeostasis in the human system
[NASA-CR-12932] N79-24640

ACOUSTIC EMISSION
Simple acoustic emission tests for the detection of corrosion
[AD-A065965] N79-24122
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
Acoustic emission and propagation of elastic pulses in a plate
N79-24768
Acoustic emission spectral calibration and analysis --- using a helium jet
[ARL-MAT-NOTE-125] N79-24772

ACOUSTIC MEASUREMENTS
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea
[AD-A066336] N79-24586
Direct methods for seismic profiling
[COO-2482-9] N79-24588
Detection of low flying aircraft by acoustical means
[REPT-8-78] N79-24779
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780

ACOUSTIC PROPAGATION
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
Internal and external models of variable parameter filters
[CEPHAG-44/77] N79-24777
Contactless measurement of carrier generation rate in semiconductors
[AD-A062880] N79-24876

ACOUSTIC PROPERTIES
JSEP achievements 1961-1978 [update of 15-year report dated September 1976]
[AD-A065670] N79-24271

ACOUSTIC SCATTERING
An investigation of the pulse-scatter imaging technique for medical ultrasonic imaging and tissue characterization
N79-24628

ACOUSTIC SOUNDING
Method for using acoustic sounder categories to determine atmospheric stability
[DP-MS-78-49] N79-24618

ACOUSTO-OPTICS
Photoacoustic spectroscopy: Its application to the study of solid materials
N79-24081
Array scanning for image transmission
[AD-A065583] N79-24825

ACTIVATED CARBON
Agitated batch and packed column activated carbon adsorption
N79-24090

ACTIVATED SLUDGE
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation
N79-24896

ACTIVITY CYCLES [BIOLOGY]
Reports from the German Meteorological Service. Volume 18, No. 144. Contributions to the phenology of Europe. Part 3: Results from international phenological gardens [regional and annual differences] 1966-1975
[ISBN-3-88148-157-5] N79-24606

ADAPTATION
Medical science in Siberia: Oxygen exchange in the Far North
[NASA-TM-75391] N79-24630

ADAPTIVE CONTROL
Design of signal synthesis model reference adaptive control systems for linear and nonlinear unknown plants
N79-24680
Adaptive observers and controllers with an arbitrarily fast exponential rate of convergence
N79-24722

ADHESIVE BONDING
Structural properties of adhesives, volume I
[AD-A065500] N79-24155
Evaluation of new bonding systems for depot-level maintenance of aircraft honeycomb panels
[AD-A066117] N79-24161
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452

ADHESIVES
Structural properties of adhesives, volume I
[AD-A065500] N79-24155
Structural properties of adhesives. Volume 2: Appendices. A: The symmetric lap shear test. B: Adhesive joint fabrication and test specifications
[AD-A065521] N79-24156
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164
Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167

ADIABATIC CONDITIONS
Method for determining the state of a fuel mixture at the inlet manifold of an M 207 motor under non-adiabatic conditions
[BLL-RTS-11509] N79-24341

ADSORPTION
Studies in the theory and practices of foam flotation techniques
N79-24077
Agitated batch and packed column activated carbon adsorption
N79-24090
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536

AEOLOTROPISM
The Boussinesq and Cerruti solutions for a transversely isotropic half-space
[OUEL-1232/78] N79-24397

AERIAL RECONNAISSANCE
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925

AEROACOUSTICS
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771

AERODYNAMIC CHARACTERISTICS
Characteristics of the advanced supersonic technology AST-105-1 configured for transpacific range with Pratt and Whitney aircraft variable stream control engines
[NASA-TM-78818] N79-23888
Some new airfoils
N79-23896
A comparison of the aerodynamic characteristics of eight sailwing airfoil sections
N79-23897
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921
Technical evaluation report on the Fluid Dynamics Panel Symposium on Dynamic Stability parameters
[AGARD-AR-137] N79-23981
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780

AERODYNAMIC COEFFICIENTS
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923

AERODYNAMIC CONFIGURATIONS
Numerical optimization techniques for bound circulation distribution for minimum induced drag of nonplanar wings: Basic formulations
[NASA-CR-3154] N79-23924
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3A: Flow angle and velocity wake profiles in low frequency band, basic investigations and hub variations
[AD-A061766] N79-23932
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3B: Flow angle and velocity wake profiles in low frequency band, air ejector systems and other devices
[AD-A061767] N79-23933
Interactional aerodynamics of the single rotor helicopter configuration. Volume 2B: Harmonic analyses of airframe surface pressure data, runs 7 - 14, midsection
[AD-A061860] N79-23934

AERODYNAMIC DRAG
An exploratory investigation of the effect of plastic coating on the profile drag of a practical-metal-construction sailplane airfoil
N79-23891
Optimum tail plane design for sailplanes
N79-23892
The effect of disturbance on a wing
N79-23893

AERODYNAMIC FORCES
Generation and breakdown of aerodynamic lift: Physical mechanism
N79-23894
AERODYNAMIC HEATING
Heat source component development program
[BMI-X-699] N79-24799
AERODYNAMIC INTERFERENCE
Aerodynamic problems in engine airframe integration on fighter airplanes
[MBB-UFE-1359-O] N79-23936
AERODYNAMIC LOADS
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
AERODYNAMIC NOISE
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770
AERODYNAMICS
Aerodynamics
[NASA-TT-F-765] N79-23908
AEROELASTICITY
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
AERONAUTICAL ENGINEERING
Diagnostics of wear in aeronautical systems
[NASA-TM-79185] N79-24350
AEROSOLS
Some examples of total aerosol weight accounted for by major inorganic soluble compounds
[AC-46] N79-24525
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
Calculation of thermal emission from aerosols using the doubling technique
[AD-A065622] N79-24575
EOMET-77: Atmospheric transmission values derived from photographs of the sea horizon
[AD-A065942] N79-24576
Seasonal variations in ultraviolet single scattering phase functions
[AD-A066160] N79-24585
AEROSPACE ENVIRONMENTS
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
The capabilities of the NASA charging analyzer program
N79-24011
Space environmental effects and the solar power satellite
N79-24028
Geosynchronous satellite operating anomalies caused by interaction with the local spacecraft environment
N79-24049
AEROSPACE MEDICINE
Validation of a model for investigating red cell mass changes during weightlessness
[NASA-CR-160188] N79-24634
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642
Experiments of USSR-CSSR cosmic flight described
N79-24939
AEROSPACE VEHICLES
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066
AFRICA
Physical properties of sediments from the continental margin of western Africa
N79-24555
Results of the geoscientific investigations from the VALDIVA cruise VA-10/1975 off Western Africa
[BMFT-FB-M-78-03] N79-24592
AFTERGLOWS
Relaxation of excited neon atoms in their parent gas
N79-24786
AGING (MATERIALS)
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
AGRICULTURE
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Nationwide forestry applications program. Ten-Ecosystem Study (TES) site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
Large Area Crop Inventory Experiment [LACIE]. Development of procedure M for multicrop inventory, with tests of a spring-wheat configuration
[E79-10197] N79-24416
AGROCLIMATOLOGY
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
AIR
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
AIR FILTERS
Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321
AIR LAND INTERACTIONS
Numerical study of the effects of complex terrain on dynamics of airflow and pollution dispersion
[CONF-790101-4] N79-24523
AIR POLLUTION
Gasohol test program
[PB-290569/3] N79-24193
Numerical study of the effects of complex terrain on dynamics of airflow and pollution dispersion
[CONF-790101-4] N79-24523
Some examples of total aerosol weight accounted for by major inorganic soluble compounds
[AC-46] N79-24525
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527
Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
Modeling of simulated photochemical smog with kinetic mechanisms, Volume 1
[PB-290507/3] N79-24531
Modelling of simulated photochemical smog with kinetic mechanisms. Volume 2: Appendix
[PB-290508/1] N79-24532
Laboratory investigation of the photooxidation and catalytic oxidation of SO2
[PB-290859/8] N79-24533
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534
Ozone/ultraviolet radiation monitoring
[PB-290594/1] N79-24539
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
An analysis of air pollution and its health effects: Washington, D.C. metropolitan area
[PB-290618/8] N79-24545
A preliminary analysis nitrous oxide (N2O) including a materials balance
[PB-290653/5] N79-24597
Method for using acoustic sounder categories to determine atmospheric stability
[DP-MS-78-49] N79-24618
AIR QUALITY
Control of volatile organic emissions from petroleum liquid storage in external floating roof tanks
[PB-290579/2] N79-24537
Emission density zoning guidebook. A technical guide to maintaining air quality standards through land-use-based emission limits
[PB-290657/6] N79-24579
A study of ozone concentrations in Southern Louisiana
[PB-291823/3] N79-24598
AIR SAMPLING
Some examples of total aerosol weight accounted for by major inorganic soluble compounds
[AC-46] N79-24525
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
AIR TRAFFIC CONTROL
The time budget as a criterion for the workload of air traffic controllers
[MBB-UFE-1353-O] N79-23943
Discrete address beacon system. A bibliography with abstracts
[NTIS/PS-79/0244/8] N79-23945
AIR TRANSPORTATION
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925
AIR WATER INTERACTIONS
A mixed layer model of wind and density driven mixing during a phytoplankton bloom
[DM-24] N79-24619
Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622
AIRBORNE/SPACEBORNE COMPUTERS
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0312/3] N79-23959
Aerospace computer systems. Part 1: Avionics applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0313/1] N79-23960
Aerospace computer systems. Part 2: Space and guided missile applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0314/9] N79-23961
Aerospace computer systems. Part 2: Space and guided missile applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0315/6] N79-23962
AIRCRAFT ACCIDENTS
Safety hazard of aircraft icing
N79-23916
AIRCRAFT ANTENNAS
Fuselage-mounted antenna code: User's manual
[AD-A065587] N79-24215
Wing-mounted antenna code: User's manual
[AD-A065589] N79-24216
An iterative approach for computing an antenna aperture distribution from given radiation pattern data
[AD-A065590] N79-24217
AIRCRAFT COMMUNICATION
Nap-of-the-earth communication program for US Army helicopters
[AD-A063089] N79-24232
AIRCRAFT CONSTRUCTION MATERIALS
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395
AIRCRAFT DESIGN
Characteristics of the advanced supersonic technology AST-105-1 configured for transpacific range with Pratt and Whitney aircraft variable stream control engines
[NASA-TM-78818] N79-23888
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780
AIRCRAFT DETECTION
Detection of low flying aircraft by acoustical means
[REPT-8-78] N79-24779
AIRCRAFT ENGINES
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158
Aircraft engine oil analysis by neutron activation techniques
[AD-A066202] N79-24169
AIRCRAFT EQUIPMENT
US Navy development of an On-Board Oxygen Generation [OBOG] system
[AD-A063958] N79-24656
AIRCRAFT FUELS
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Design and evaluation of aircraft heat source systems for use with high-freezing point fuels
[NASA-CR-159568] N79-24172
AIRCRAFT HAZARDS
Aircraft icing
[NASA-CP-2086] N79-23912
Aircraft icing: Introduction
N79-23913
Executive summary of Aircraft Icing Specialists Workshop
N79-23914
Icing of aircraft Some remarks with an historical slant from a cloud physicist
N79-23915
Civil Helicopter icing problems
N79-23917
A review of the icing situation from the standpoint of general aviation
N79-23918
Overview of helicopter ice protection system developments
N79-23919
AIRCRAFT LANDING
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recover from small ships. Volume 2: Appendices
[AD-A066173] N79-23955

AIRCRAFT MAINTENANCE
Evaluation of new bonding systems for depot-level maintenance of aircraft honeycomb panels
[AD-A066117] N79-24161
AIRCRAFT MANEUVERS
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
AIRCRAFT NOISE
Aircraft sonic boom: Biological effects. A bibliography with abstracts
[NTIS/PS-79/0190/3] N79-24650
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
Statistical comparisons of aircraft flyover noise adjustment procedures for different weather conditions
[NASA-TP-1430] N79-24773
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780
AIRCRAFT PRODUCTION
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938
AIRCRAFT STRUCTURES
Substructuring methods for design sensitivity analysis and structural optimization
[AD-A065935] N79-23949
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951
Prediction of the angular response power spectral density of aircraft structures
[AD-A066141] N79-23956
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures
[NASA-CASE-ARC-11241-1] N79-24153
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202
AIRCRAFT WAKES
Aircraft wake vortices. A bibliography with abstracts
[NTIS/PS-79/0166/3] N79-23939
AIRFOIL PROFILES
Low-speed single-element airfoil synthesis N79-23890
A comparison of the aerodynamic characteristics of eight sailwing airfoil sections N79-23897
A finite element method for the computation of the transonic potential flow past airfoils
[MBB-UFE-1352-O] N79-23935
Airfoil optimization for transonic flow using the methods of finite elements and characteristics
[MBB-UFE-1362-O] N79-23937
AIRFOILS
Low-speed single-element airfoil synthesis N79-23890
An exploratory investigation of the effect of plastic coating on the profile drag of a practical-metal-construction sailplane airfoil N79-23891
Some new airfoils N79-23896
AIRFRAME MATERIALS
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
AIRFRAMES
Interactional aerodynamics of the single rotor helicopter configuration. Volume 2B: Harmonic analyses of airframe surface pressure data, runs 7 - 14, midsection
[AD-A061860] N79-23934
The production function and airframe cost estimation
[AD-A065570] N79-23952
ANALYZE: Analysis of aerospace structures with membrane elements
[AD-A065633] N79-24379
AIRSHIPS
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925
AIRSPEED
Wing shape optimization for maximum cross-country speed, with mathematical programming N79-23899
ALGAE
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418
Role of inorganic carbon availability in the formation of nuisance blooms of blue-green algae
[PB-290716/0] N79-24542
ALGORITHMS
An implicit algorithm for the conservative, transonic full-potential equation with effective rotated differencing
[NASA-TM-78570] N79-23909
Preliminary results of the determination of the orientation of Interkosmos-17 AUOS
[NASA-TM-75613] N79-23994
Real-time video filtering with bit-slice microprogrammable processors N79-24207
Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
Characteristics and applications of distributed associative memory algorithms N79-24661
Parallel algorithms for multiple processor architectures N79-24663
Algorithmic and computer code developments for combinatorial and network problems N79-24679
Construction of integral quadratic forms N79-24691
ALIGNMENT
Driveshaft alignment indicator
[AD-A065988] N79-23973
ALKALIES
Basic studies of high performance multialkali photocathodes
[AD-A066064] N79-24273
ALKENES
Hydropyrolysis of coal derived liquids and related model compounds N79-24171
ALLOCATIONS
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429
ALUMINATES
Some physical and chemical properties of sodium-aluminate solutions
[BLL-RTS-11347] N79-24074
ALUMINUM
Fabrication of J79 boron/aluminum compressor blades
[NASA-CR-159566] N79-23970
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
Thermal conductivity of granular aluminum N79-24852
Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum N79-24862
ALUMINUM ALLOYS
Relation of structure to fatigue properties in aluminum-base alloys
[AD-A062698] N79-24127
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 1
[LBF-TB-111-VOL-1] N79-24400
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 2
[LFB-TB-112-VOL-2] N79-24401
ALUMINUM COMPOUNDS
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112
High energy proton radiation damage to [AlGa]As-GaAs solar cells
[NASA-CR-3148] N79-24261
ALUMINUM GALLIUM ARSENIDES
Research on lattice-mismatched semi-conductor layers --- AlGaAsSb systems
[SAN-1250-4] N79-24880
ALUMINUM SILICATES
High surface area amorphous silica-alumina cracking catalysts with controlled site spacings
[CSIR-CENG-232] N79-24068
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112
AMBIENT TEMPERATURE
Energy storage with ambient temperature rechargeable lithium batteries
[PB-290934/9] N79-24518
AMINES
Application of foam separation to aqueous solutions of trinitrotoluene [TNT]. Part 2: Removal of organic explosives with surfactants
[AD-A066118] N79-24103
AMMONIA
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
AMMONIUM CHLORIDES
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295
AMORPHOUS MATERIALS
High surface area amorphous silica-alumina cracking catalysts with controlled site spacings
[CSIR-CENG-232] N79-24068
AMPLIFIERS
Inductorless narrow-band filter/amplifier
[NASA-CASE-GSC-12410-1] N79-24260
High power millimeter wave amplifier
[AD-A062966] N79-24275
AMPLITUDES
The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere N79-24547
ANALOG TO DIGITAL CONVERTERS
Electrochemical detection device --- for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073
ANALYSIS [MATHEMATICS]
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308
Stabilization of magnetohydrodynamic instabilities in a current-carrying stellarator
[IPPJ-368] N79-24836
ANALYSIS OF VARIANCE
A Gaussian approximation to the distribution of sample variance for nonnormal populations
[AD-A065738] N79-24699
ANALYTIC FUNCTIONS
Diffraction by a dielectric wedge
[AD-A065699] N79-24762
ANALYTICAL CHEMISTRY
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098
Proposed implementation of laser Raman scattering spectroscopy for analysis of hydrogen isotopes
[MLM-2583] N79-24107
ANELASTICITY
Inelastic resistance calculations with time dependent thermal and mechanical stress
[ISD-238] N79-24390
ANGULAR ACCELERATION
Eckart frame motions and molecular vibrations --- with emphasis on angular motion and angular acceleration N79-24789
ANGULAR VELOCITY
Eckart frame motions and molecular vibrations --- with emphasis on angular motion and angular acceleration N79-24789
ANNEALING
Effect of annealing below the glass transition temperature on sorption and transport of carbon dioxide in polycarbonate N79-24148
Development of preferred orientation in uniaxially deformed olivine aggregates N79-24554
ANNUAL VARIATIONS
Global distribution of ozone for various seasons
[NASA-TM-75435] N79-24564
Change of the temperature trend over the North Atlantic since 1970
[BLL-TRANS-1392-(9022.549)] N79-24603
ANNULAR FLOW
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920
ANNULAR PLATES
Vibration and stability of beam reinforced polar orthotropic annular plates of uniform and variable thickness N79-24363
Flexural vibrations of annular plates under uniform inplane compressive forces --- using Rayleigh-Ritz method N79-24375
ANOMALIES
Geosynchronous satellite operating anomalies caused by interaction with the local spacecraft environment N79-24049

Anomaly of the composition of the F-2 equatorial region of the ionosphere during the hours after sunset according to data from the mass-spectrometer experiment on the Cosmos-274
[NASA-TM-75615] N79-24565

Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857

ANTARCTIC REGIONS

The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere
N79-24547

ANTENNA ARRAYS

Phase conjugation method and apparatus for an active retrodirective antenna array
[NASA-CASE-NPO-13641-1] N79-24210

Effects of antenna arrays on broadband signals
[AD-A064679] N79-24231

An investigation on characterizing mutual coupling between tow antenna slots on a cone
[AD-A066330] N79-24234

ANTENNA DESIGN

Antennas and the associated time domain range for the measurement of impulsive fields
[PB-291733/4] N79-24253

ANTENNA RADIATION PATTERNS

Multiple antenna beam formation techniques for synthetic aperture radar
N79-24206

Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213

High frequency near field scattering by an elliptic disk
[AD-A065586] N79-24214

Fuselage-mounted antenna code: User's manual
[AD-A065587] N79-24215

Wing-mounted antenna code: User's manual
[AD-A065589] N79-24216

An iterative approach for computing an antenna aperture distribution from given radiation pattern data
[AD-A065590] N79-24217

Evaluation and analysis of Seasat-A scanning multichannel Microwave Radiometer [SMMR] Antenna Pattern Correction [APC] algorithm
[NASA-CR-158674] N79-24420

ANTENNAS

Noise performance of broadband amplifiers for use with electrically small antennas
N79-24208

ANTIKNOCK ADDITIVES

Fluid bed process studies on selective conversion of methanol to high octane gasoline
[FE-2490-15] N79-24190

ANTIMONY ALLOYS

Research on lattice-mismatched semi-conductor layers --- AlGaAsSb systems
[SAN-1250-4] N79-24880

ANTIPROTONS

Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807

APOLLO 11 FLIGHT

Apollo 11: A good ending to a bad decade
[NASA-NEWS-RELEASE-79-73] N79-23986

APPLICATIONS PROGRAMS [COMPUTERS]

The application of microprocessor technology to in-flight computation
N79-23902

APPROXIMATION

Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910

Some uniqueness problems in nonlinear L sub p-approximation
N79-24693

On rational approximations of semigroups
[CTH-MATH-1978-3] N79-24729

AQUEOUS SOLUTIONS

Evaluation of flow properties of dilute aqueous polymer solutions for enhanced oil recovery applications
N79-24408

ARC DISCHARGES

TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053

ARC JET ENGINES

Mechanisms of magnetoplasmadynamic arcjet acceleration processes
[AD-A065617] N79-24060

ARCHES

A class of structural optimization problems: Optimal archgrids
[ISD-236] N79-24388

ARCHITECTURE [COMPUTERS]

Communication complexity of distributed shortest path algorithms
[AD-A066152] N79-24237

Parallel algorithms for multiple processor architectures
N79-24663

ARGENTINA

The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414

ARGON

Nitrogen excitation by metastable argon atoms
[LP-170] N79-24850

ARIZONA

Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415

ARKANSAS

Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410

AROMATIC COMPOUNDS

Steam reforming of aromatic compounds
N79-24093

Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168

ARRAYS

Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821

ARRESTERS

Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104

ARTIFICIAL SATELLITES

A review of recent results on spread F theory
[AD-A066175] N79-24233

TEMPUS: A proposal for international time transfer and precision tracking satellite
N79-24760

ASSOCIATIVE PROCESSING [COMPUTERS]

Characteristics and applications of distributed associative memory algorithms
N79-24661

ASTRONAUT LOCOMOTION

Spacesuit mobility knee joints
[NASA-CASE-ARC-11058-2] N79-24651

ASTRONOMICAL OBSERVATORIES

Pulsar timing results from Arecibo Observatory
N79-24917

ASTRONOMICAL TELESCOPES

Heliostat for astronomical usage
[NASA-TM-75481] N79-24920

ASTRONOMY

Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916

ASTROPHYSICS

Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations
N79-24886

Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916

ASYMPTOTIC METHODS

Convergence of non-ergodic dynamic systems --- non-interfacing particles
[CTH-MATH-1977-18] N79-24720

ASYMPTOTIC SERIES

An asymptotic result for the scattering of a plane wave by a smooth convex cylinder
[AD-A065588] N79-24229

Asymptotic stability of a class of nonlinear singularly perturbed systems
[AD-A062957] N79-24701

ATLANTIC OCEAN

Change of the temperature trend over the North Atlantic since 1970
[BLL-TRANS-1392-(9022.549)] N79-24603

ATMOSPHERIC ATTENUATION

Tuned diode laser measurements of atmospheric absorption profiles in the 4.5 micrometers to 5.0 micrometers region
[AD-A066159] N79-24584

ATMOSPHERIC BOUNDARY LAYER

A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems
N79-24553

Wind engineering research digest, volume 3, 1978 --- a bibliography of ongoing research projects
[PB-290694/9] N79-24621

ATMOSPHERIC CHEMISTRY

Activities of the International Meteorological Institute
[AR-77-78] N79-24590

ATMOSPHERIC CIRCULATION

Numerical study of the effects of complex terrain on dynamics of airflow and pollution dispersion
[CONF-790101-4] N79-24523

The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere
N79-24547

Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567

Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609

Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610

Preliminary zonal model analysis of the climatic change resulting from increased atmospheric carbon dioxide
[UCRL-81575] N79-24617

Method for using acoustic sounder categories to determine atmospheric stability
[DP-MS-78-49] N79-24618

ATMOSPHERIC COMPOSITION

Results of aerial and surface ozone measurements during the second half of 1977
[SONDERBEOB-36] N79-24591

ATMOSPHERIC EFFECTS

Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321

ATMOSPHERIC HEAT BUDGET

Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622

ATMOSPHERIC MODELS

Ion-molecule interactions of atmospheric importance
N79-24551

Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567

Studies in ionospheric ray tracing
[CSIR-R-MAG-5/17] N79-24573

Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609

Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610

Preliminary zonal model analysis of the climatic change resulting from increased atmospheric carbon dioxide
[UCRL-81575] N79-24617

ATMOSPHERIC MOISTURE

A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems
N79-24553

ATMOSPHERIC PHYSICS

Activities of the International Meteorological Institute
[AR-77-78] N79-24590

ATMOSPHERIC RADIATION

Atmospheric neutrons
[NASA-CR-3126] N79-24631

ATMOSPHERIC REFRACTION

Atmospheric refraction measurements and related efforts
[AD-A065766] N79-24574

ATMOSPHERIC SCATTERING

Calculation of thermal emission from aerosols using the doubling technique
[AD-A065622] N79-24575

EOMET-77: Atmospheric transmission values derived from photographs of the sea horizon
[AD-A065942] N79-24576

Seasonal variations in ultraviolet single scattering phase functions
[AD-A066160] N79-24585

ATMOSPHERIC TEMPERATURE

Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928

ATMOSPHERICS

Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615

ATOM CONCENTRATION

Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing
N79-24858

ATOMIC BEAMS

Continuum absorption coefficient of atoms and ions
[NASA-CR-158536] N79-24791

ATOMIC CLOCKS

Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks
N79-24738

Performance of preproduction model cesium beam frequency standards for spacecraft applications
N79-24740

ATOMIC COLLISIONS
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions N79-24782
ATOMIC ENERGY LEVELS
High-temperature series expansion for the singlet-triplet model N79-24864
ATOMIC EXCITATIONS
A proton activation study of oxygen diffusion in multicomponent glass-forming systems N79-24152
Relaxation of excited neon atoms in their parent gas N79-24786
Measurements of the differential scattering cross sections of electron excited Na on Hg [MPIS-13/1977] N79-24804
On tha reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl [MPIS-19/1977] N79-24805
Field theories with multiple Fermionic excitations N79-24806
Nitrogen excitation by metastable argon atoms [LP-170] N79-24850
ATOMIC SPECTRA
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames [AD-A066083] N79-24100
Measurement and comparison of relative free-atom fractions in the helium-oxygen-acetylene and air-acetylene flames [AD-A066153] N79-24797
ATOMIC STRUCTURE
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds N79-24076
ATOMS
A theoretical study into the spatial distribution of atoms surrounding an individual solute particle vaporizing in an analytical flame [AD-A066182] N79-24796
ATS 5
ATS-5 and ATS-6 potentials during eclipse N79-24005
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source N79-24006
ATS 6
ATS-5 and ATS-6 potentials during eclipse N79-24005
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source N79-24006
Operations of the ATS-6 ion engine N79-24007
Characteristics of differential charging of ATS-6 N79-24008
ATTITUDE [INCLINATION]
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors [PB-292963/6] N79-24513
AUDITORY PERCEPTION
Studies on the microwave-induced auditory effect [PB-290598/2] N79-24648
AURORAL ARCS
Auroral magnetosphere-ionosphere coupling: A brief topical review [NASA-CR-158662] N79-24572
AURORAS
Collisionless evolution of the auroral electron velocity distribution function N79-24548
Distribution of positive ion species above a diffuse midnight aurora N79-24550
Convective electric field measurements in an auroral plasma N79-24552
AUSTRALIA
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia [E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia [E79-10194] N79-24414
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data [NASA-TM-79689] N79-24421
AUTOCORRELATION
The theory of spectrum analysis of stochastic processes [REPT-0-78] N79-24109
Spectral analysis by means of autoregressive filter [CEPHAG-41/77] N79-24241
The Hankel autocorrelation --- and Hankel spectrum N79-24690
AUTOMATA THEORY
Research shows ways to facilitate introduction of ASU's N79-24948
AUTOMATIC CONTROL
Priority loss systems: Unequal holding times [AD-A066245] N79-24239
Circuit for automatic load sharing in parallel converter modules [NASA-CASE-NPO-14056-1] N79-24257
Proceedings of the distribution automation and control working group. Volume 1: Executive summary [NASA-CR-158642] N79-24259
Automated solar panel assembly line. LSA task; production processes and equipment [NASA-CR-158671] N79-24455
AUTOMATIC FLIGHT CONTROL
Evaluation of a digital helicopter control system --- BO-105 helicopter [MBB-UFE-1349-O] N79-23980
AUTOMATION
An automated retrieval system for frequency allocation information [PB-291600/5] N79-24251
AUTOMOBILE ENGINES
The 1.11 new considerations on the development of vortex ports --- for small capacity direct injection engine [BLL-RTS-11759] N79-24347
AUTOMOBILE FUELS
Motor gasolines, summer 1978 [BETC/PPS-79/1] N79-24189
Fluid bed process studies on selective conversion of methanol to high octane gasoline [FE-2490-15] N79-24190
AUTOMOBILES
Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions [PB-290612/1] N79-24191
Pneumatic Carburation [PC] for internal combustion engines with spark ignition [BLL-RTS-11758] N79-24345
Automotive Fuel Economy Contractor's Coordination Meeting [PB-290516/4] N79-24358
AUXILIARY POWER SOURCES
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program --- for the space shuttle orbiter [NASA-CR-160178] N79-24672
AVALANCHE DIODES
The III - V heterostructure avalanche photodiode modules for fiber optic communication links in the 1.0 to 1.3 micrometer spectral range [AD-A065537] N79-24272
GaAs electroabsorption avalanche photodiode waveguide detectors [AD-A065986] N79-24824
AVALANCHES
Evaluation and prediction of avalanche hazard, San Juan Mountains, Colorado [PB-290854/9] N79-24594
AVIONICS
Avionics standardization potential analysis [AD-A066138] N79-23958
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts [NTIS/PS-79/0312/3] N79-23959
Aerospace computer systems. Part 1: Avionics applications, volume 3. A bibliography with abstracts [NTIS/PS-79/0313/1] N79-23960
AXIAL STRAIN
Development of preferred orientation in uniaxially deformed olivine aggregates N79-24554
AZINES
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures [NASA-CASE-ARC-11241-1] N79-24153

B

BACKGROUND RADIATION
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe [NASA-TM-75619] N79-24934
BACKSCATTERING
Interpretation of enhanced laser-plasma backscattering due to prepulse radiation N79-24340
Study and analysis of equatorial irregularities, total electron content, and scintillations [AD-A065550] N79-24577
BALANCE
The balance of rollers for high DN bearings [AD-A065899] N79-24356
BALL BEARINGS
Evaluation of SHABERTH: A bearing simulation computer program [NASA-CR-161205] N79-24349
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings [AD-A065554] N79-24355
BALL LIGHTNING
On the quantum mechanical theory of ball lightning [BLL-CTO/1580-[9091.9F]] N79-24563
BALLOON-BORNE INSTRUMENTS
Localized sources of gamma rays of 3 to 25 MeV N79-24933
BALTIC SEA
A mixed layer model of wind and density driven mixing during a phytoplankton bloom [DM-24] N79-24619
BANACH SPACE
Bifurcation of periodic solutions in functional differential equations N79-24684
On rational approximations of semigroups [CTH-MATH-1978-3] N79-24729
BAND STRUCTURE OF SOLIDS
Influence of thermal disorder on electronic properties of solids --- direct current conductivity and optical properties N79-24872
BANDWIDTH
Inductorless narrow-band filter/amplifier [NASA-CASE-GSC-12410-1] N79-24260
BARIUM
Differential cross section measurements for electron impact on barium in ground and laser excited states N79-24785
BAROCLINITY
Barotropic and baroclinic instabilities in jupiter's zonal flow N79-24926
BAROTROPIC FLOW
Barotropic and baroclinic instabilities in jupiter's zonal flow N79-24926
BASES [CHEMICAL]
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments [COO-2421-5] N79-24132
BATHS
Nickel coatings achieved without the use of electric current [BLL-RTS-11605] N79-24113
BAYES THEOREM
Further theory of stable decisions N79-24710
BEAMS [RADIATION]
Wave interaction in a beam-plasma system in the presence of dispersion and higher order nonlinear effects [CTH-IEFT/PP-1977-15] N79-24848
BEAMS [SUPPORTS]
Flexural behavior of reinforced sulfur-infiltrated concrete beams N79-24196
Large deflection response of elastic/visco-plastic beams under combined tension and bending N79-24366
Optimal beam layouts: Allowance for cost of shear [ISD-237] N79-24389
BEARINGS
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems [AD-A065923] N79-24354
BEAUFORT SEA [NORTH AMERICA]
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea [AD-A066336] N79-24586
BENDING
Large deflection response of elastic/visco-plastic beams under combined tension and bending N79-24366
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition N79-24788
BIBLIOGRAPHIES
Aircraft wake vortices. A bibliography with abstracts [NTIS/PS-79/0166/3] N79-23939
Discrete address beacon system. A bibliography with abstracts [NTIS/PS-79/0244/8] N79-23945
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[NTIS/PS-79/0314/9] N79-23961
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[NTIS/PS-79/0315/6] N79-23962
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[NTIS/PS-79/0179/6] N79-24137
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[NTIS/PS-79/0221/6] N79-24140
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[NTIS/PS-79/0233/1] N79-24317
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[NTIS/PS-79/0259/6] N79-24319
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[NTIS/PS-79/0264/6] N79-24780

BINARY FLUIDS
Transport properties of binary mixtures of dense hard-sphere fluids
N79-24291

BINARY MIXTURES
Transport properties of binary mixtures of dense hard-sphere fluids
N79-24291

BIOCHEMISTRY
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990

BIOCONTROL SYSTEMS
User's instructions for the 41-node thermoregulatory model [steady state version]
[NASA-CR-160220] N79-24638
Acid-base homeostasis in the human system
[NASA-CR-12932] N79-24640

BIODEGRADATION
Biodegradable polymer: Synthesis and characterization of methyl- and hydroxyl-containing polyamides, polyfumaramides, and polyenamines
N79-24147

BIOLOGICAL EFFECTS
An analysis of air pollution and its health effects: Washington, D. C. metropolitan area
[PB-290618/8] N79-24545

BIOMASS
Densified biomass: A new form of solid fuel
[SERI-35] N79-24180

BIOMASS ENERGY PRODUCTION
Hydrocarbons and energy from plants
[LBL-8596] N79-24507

BIOMEDICAL DATA
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642

BIOTECHNOLOGY
Analytical methods for biotechnological design of man machine systems: Work on system ergonomy
[FB-28] N79-24315
Emergence of biotechnology
[TID-28983] N79-24626

BIPOLAR TRANSISTORS
Bipolar dynamic memory cells
N79-24943

BISMUTH
Low temperature properties of bismuth films in large electric and magnetic fields
N79-24867

BISTABLE CIRCUITS
Bistable [latching] solenoid actuated propellant isolation valve
[NASA-CR-158673] N79-24352

BISTATIC REFLECTIVITY
Considerations concerning detection of noncooperative illuminated targets
[REPT-2-78] N79-24245

BITUMENS
Analysis of coal hydrogasification processes
[FE-2565-13] N79-24183

BIVARIATE ANALYSIS
Bivariate nonparametric tests for the one-sample location problem
N79-24711

BLADE TIPS
An investigation of a full-scale rotor with four blade tip planform shapes --- in Ames Research Center 40 by 80 Foot Wind Tunnel
[NASA-TM-78580] N79-23922

BLOCK DIAGRAMS
Polynomial representations and an iterative procedure for filter realization
N79-24255

BLOOD CIRCULATION
A long term model of circulation --- human body
[NASA-CR-147674] N79-24636

BODY FLUIDS
Fluid and Electrolyte Balance model [FEB]
[NASA-CR-160206] N79-24633
Chemicals identified in human biological media, a pilot literature survey
[PB-290690/7] N79-24649

BOILERS
Optimum combinations of cooling alternatives for stream-electric power plants, volume 2
[PB-290576/8] N79-24515
Feasibility and economics of cogeneration in California's thermal enhanced oil recovery operations
[PB-291794/6] N79-24517
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534

BOLTS
Test and evaluation of split ring shear connectors in laminated wood and laminated wood bolts
[AD-A066323] N79-24381

BOLTZMANN TRANSPORT EQUATION
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338
Collisionless evolution of the auroral electron velocity distribution function
N79-24548

BONDING
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431

BOOLEAN ALGEBRA
Projections and measures
N79-24725

BORON
Fabrication of J79 boron/aluminum compressor blades
[NASA-CR-159566] N79-23970

BOUNDARY LAYER CONTROL
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920

BOUNDARY LAYER FLOW
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319

BOUNDARY LAYER SEPARATION
Length and bursting of separation bubbles: A physical interpretation --- of pressure distribution
N79-23898
An experimental study of transonic turbulent flow separation
N79-23907
Rotational flows in electrically conducting and nonconducting fluids
N79-24289

BOUNDARY LAYER STABILITY
Barotropic and baroclinic instabilities in jupiter's zonal flow
N79-24926

BOUNDARY LAYER TRANSITION
Turbulent boundary layer structure and drag reduction
[AD-A065667] N79-24303

BOUNDARY LAYERS
Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910
An experimental investigation of the natural convection boundary layer over a uniform flux inclined surface
N79-24294

BOUNDARY VALUE PROBLEMS
Existence and approximations for saddle-point problems with application to nonlinear incompressible elasticity
N79-24365
Comparison of accuracies of solutions of linear shell theories for closed circular cylinders under edgewise loading
[NAL-TR-552T] N79-24370
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396
A modified Robbins-Monro procedure and its applications
N79-24716
Propagation of ion acoustic cnoidal wave
[IPPJ-367] N79-24837

BRAKES [FOR ARRESTING MOTION]
The acceleration and braking capability of hydrostatic transmissions
[BLL-RTS-11821] N79-24348

BRANCHING [MATHEMATICS]
Bifurcation of periodic solutions in functional differential equations
N79-24684

BRAZIL
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[E79-10194] N79-24414

BRITTLE MATERIALS
Production of cracks in ZnS under a uniform dynamic stress field
[AD-A065941] N79-24159

BROADBAND
Effects of antenna arrays on broadband signals
[AD-A064679] N79-24231
Survey of timing/synchronization of operating wideband digital communications networks
N79-24747

BROADBAND AMPLIFIERS
Noise performance of broadband amplifiers for use with electrically small antennas
N79-24208

BROADCASTING
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999

BROMINE COMPOUNDS
On the reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl
[MPIS-19/1977] N79-24805

BRONZES
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865

BUBBLE TECHNIQUE
Magnetic bubble traveling-wave amplifier
[AD-A065512] N79-24269

BUBBLES
Length and bursting of separation bubbles: A physical interpretation --- of pressure distribution
N79-23898

BUCKLING
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376
Geometrically nonlinear finite element behavior using buckling mode superposition
[ISD-241] N79-24391

BUILDINGS
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BULGARIA
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[JPRS-73404] N79-23990
BURNING RATE
Sensitivity of burning rate to initial temperature for a binary magnesium-sodium nitrate mix
[AD-A066119] N79-24175
BUTANES
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104
BY-PRODUCTS
Hydropyrolysis of coal derived liquids and related model compounds
N79-24171

C

CALCIUM FLUORIDES
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440
CALCIUM ISOTOPES
Studies of calcium isotope fractionation found in nature and produced during ion sputtering
N79-24927
CALENDARS
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
CALIBRATING
Measurement assurance for gage blocks
[PB-292020/5] N79-24200
Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321
Acoustic emission spectral calibration and analysis -- using a helium jet
[ARL-MAT-NOTE-125] N79-24772
CALIFORNIA
HCMM: Soil moisture in relation to geologic structure and lithology, northern California
[E79-10192] N79-24412
Solar project description: Aratex Services, Incorporated, industrial laundry, Fresno, California
[SOLAR/2008-78/50] N79-24485
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757
CANADA
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[E79-10194] N79-24414
CAPILLARY WAVES
Numerical calculations of periodic gravity-capillary waves
N79-24287
CARBON
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792
Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853
CARBON DIOXIDE
Effect of annealing below the glass transition temperature on sorption and transport of carbon dioxide in polycarbonate
N79-24148
Role of inorganic carbon availability in the formation of nuisance blooms of blue-green algae
[PB-290716/0] N79-24542
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
CARBON DIOXIDE CONCENTRATION
Preliminary zonal model analysis of the climatic change resulting from increased atmospheric carbon dioxide
[UCRL-81575] N79-24617
CARBON FIBERS
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061
The potential for accidental release of carbon/graphite fibers from resin matrix composites as determined by thermogravimetric analysis
[AD-A065962] N79-24070
CARBON MONOXIDE
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts
N79-24092
The effect of carbon monoxide and methane on the resistance of tin oxide thin films
N79-24256
Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
CARBON STEELS
Morphology and mechanism of hydrogen attack in iron-carbon alloys
N79-24117
CARBONYL COMPOUNDS
Pathways for intramolecular carbonyl exchange in some metal carbonyl complexes
N79-24115
CARDIOVASCULAR SYSTEM
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643
CARIBBEAN SEA
Disturbed versus undisturbed conditions in the Caribbean during the intensification of Hurricane Carmen [1974]
[AD-A065517] N79-24612
CARRIER FREQUENCIES
Contactless measurement of carrier generation rate in semiconductors
[AD-A062880] N79-24876
CARRIERS
Developing a domestic common carrier telecommunications policy: What are the issues
[PB-290787/1] N79-24249
CASCADE FLOW
Numerical calculation of inviscid transonic flow through rotors and fans
N79-23906
CASTING
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470
CATALYSIS
Laboratory investigation of the photooxidation and catalytic oxidation of SO2
[PB-290859/8] N79-24533
CATALYSTS
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts
N79-24092
CATALYTIC ACTIVITY
High surface area amorphous silica-alumina cracking catalysts with controlled site spacings
[CSIR-CENG-232] N79-24068
Engineering implications following the attachment of catalytically active transition metal complexes onto solid supports the leaky catalyst
N79-24080
CATASTROPHE THEORY
Catastrophe theory in Hilbert Space
[CTH-MATH-1977-17] N79-24703
CATIONS
Spectroscopic investigations of metal cation reduction at glass surfaces
N79-24079
CAVITATION FLOW
Multi-fluid, high temperature cavitation tunnel: Description and operating manual
[OUEL-1196/77] N79-24311
Viscous effects on cavitation inception on a two dimensional cylinder
[OUEL-1225/78] N79-24312
Vapour flows and heat conductances in ventilated cavities behind a two-dimensional cylinder. Part 1: Review of entrainment and thermodynamic effect; viscous effects on limited and developed cavitation
[OUEL-1245/78] N79-24314
CAVITIES
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319
CENSORED DATA [MATHEMATICS]
Weak convergence of progressively censored likelihood ratio processes
N79-24712
CENTRAL PROCESSING UNITS
Multimode CPU design study
[AD-A066241] N79-24666
CERAMICS
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Numerical investigations of fracture and micromechanics in ceramics
[AD-A066252] N79-24166
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453
Basic research on ceramic materials for energy storage and conversion system
[COO-2564-4] N79-24506
CESIUM
Performance of preproduction model cesium beam frequency standards for spacecraft applications
N79-24740
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784
CESIUM ALLOYS
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
CHAFF
A methodology for an effectiveness analysis of RPV's in a chaff dispensing role
[AD-A065557] N79-23953
CHALCOGENIDES
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
CHANNELS [DATA TRANSMISSION]
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Operating manual for the RRL 8 channel data logger
[NASA-CR-158633] N79-24671
CHARACTERIZATION
Status of materials characterization studies
N79-24030
CHARGE DISTRIBUTION
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024
Area scaling investigations of charging phenomena -- discharge pulse characteristics of Teflon thermal control tape
N79-24032
Electric fields in irradiated dielectrics
N79-24035
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
Secondary electron effects on spacecraft charging
N79-24048
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807
CHARGE EXCHANGE
Charging rates of metal-dielectric structures --- with implications for spacecraft
N79-24033
CHARGE TRANSFER
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784
CHARGED PARTICLES
Interactions between spacecraft and the charged-particle environment
N79-24021
Plasma Interaction Experiment [PIX] flight results
N79-24022
Effect of parasitic plasma currents on solar-array power output
N79-24025
Magnetic shielding of large high-power-satellite solar arrays using internal currents
N79-24026
Potential mapping with charged-particle beams
N79-24038
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
Channeling of charged particles
N79-24945
CHEMICAL ANALYSIS
Hydrogen depth profiling using elastic recoil detection --- using helium ions
[SAND-79-0210C] N79-24878
CHEMICAL ATTACK
Morphology and mechanism of hydrogen attack in iron-carbon alloys
N79-24117
CHEMICAL BONDS
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds
N79-24076
CHEMICAL COMPOSITION
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521

Some examples of total aerosol weight accounted for by major inorganic soluble compounds
[AC-46] N79-24525
CHEMICAL COMPOUNDS
Chemicals identified in human biological media, a pilot literature survey
[PB-290690/7] N79-24649
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
CHEMICAL FRACTIONATION
Studies of calcium isotope fractionation found in nature and produced during ion sputtering
N79-24927
CHEMICAL LASERS
Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330
CHEMICAL PROPERTIES
Some physical and chemical properties of sodium-aluminate solutions
[BLL-RTS-11347] N79-24074
Research in fluorine chemistry
[AD-A065527] N79-24099
Phase equilibrium and volumetric properties of coal-derived fluids
[FE-2278-9] N79-24179
CHEMICAL REACTIONS
Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167
CHEMICAL REACTORS
A chemically reacting, turbulent shear layer
N79-24286
Feasibility study of the application of self-tuning controllers to chemical batch reactors --- temperature control
[OUEL-1248/78] N79-24326
CHEMILUMINESCENCE
On the correlation of the kinetics of electron transfer processes with the change in reaction free energy. Application to electron-exchange initiated chemiluminescence reactions
[AD-A066342] N79-24105
CHINA
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
CHIPS [ELECTRONICS]
Manufacturing methods and technology engineering for tape chip carrier
[AD-A065890] N79-24270
CHLORINE
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls
N79-24085
CHLORINE COMPOUNDS
On the reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl
[MPIS-19/1977] N79-24805
CHLOROCARBONS
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls
N79-24085
CHOKES [RESTRICTIONS]
Improved techniques for gasifying coal
[FE-2340-7] N79-24186
CHROMOSPHERE
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932
CIRCUIT BOARDS
Deleterious effect of MIL-F-14256, type RA fluxes on printed wiring boards
[AD-A066129] N79-24274
CIRCUITS
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
Hot-wire and hot-film anemometry
[NASA-TM-75413] N79-24323
CIRCULAR CYLINDERS
Comparison of accuracies of solutions of linear shell theories for closed circular cylinders under edgewise loading
[NAL-TR-552T] N79-24370
CIRCULATORY SYSTEM
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
CIRRUS CLOUDS
Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582
CITIES
Methodologies of examining pollution from urban runoff
[PB-290595/8] N79-24427
Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
Urban water resources policy alternatives: A sociological analysis of differential perspectives
[PB-290583/4] N79-24538
Temporal and spatial distribution of humidity in a small city
N79-24599
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910
CIVIL AVIATION
Civil Helicopter icing problems
N79-23917
CLASSIFICATIONS
Optimum frequencies for aircraft classification
[AD-A065697] N79-24220
Types of karst, with emphasis on cover beds in their classification and development
N79-24556
CLIMATE
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
CLINICAL MEDICINE
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
CLOCKS
Clock performance as a critical parameter in navigation satellite systems
N79-24750
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757
Clock synchronisation experiment in India using symphonie satellite
N79-24758
CLOSED CIRCUIT TELEVISION
High speed TV-towing system for project definition study for conception and design of a deep sea towing system with two instrumented exploration instrumental bodies in a tandem configuration for close to sea floor control
[BMFT-FB-M-77-05] N79-24623
CLOSED CYCLES
LSA silicon material task closed-cycle process development
[NASA-CR-158677] N79-24449
CLOUD COVER
Scattering of solar radiation by clouds
[AD-A062828] N79-24826
CLOUD SEEDING
A comparison of theoretical and experimental results in supercooled stratus dispersal
[AD-A063013] N79-24581
CLOUDS
A study of molecular clouds near supernova remnants
N79-24924
CLUMPS
Ion-molecule interactions of atmospheric importance
N79-24551
Piecewise polynomials for the probability of clustering on the unit interval
N79-24714
COAL
Development of a modular software system for the dynamic simulation of coal conversion plants
[FE-2338-10] N79-24176
Solvent Refined Coal [SRC] process: Operation of solvent refined coal pilot plant
[FE-2270-34] N79-24181
Clean solid and liquid fuels from coal
[FE-2047-8] N79-24185
Systems studies of coal conversion processes using a reference simulator
[FE-2275-8] N79-24187
Development of sensitized pick coal interface detector system
[NASA-CR-161225] N79-24417
COAL GASIFICATION
Analysis of coal hydrogasification processes
[FE-2565-13] N79-24183
Pipeline gas from coal-hydrogenation: IGT hydrogasification process, project 9000
[FE-2434-29] N79-24184
Improved techniques for gasifying coal
[FE-2340-7] N79-24186
Low Btu coal gasification processes. Volume 1: Summary, screening, and comparisons
[ORNL/ENG/TM-13-VOL-1] N79-24188
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
In situ coal gasification modeling
[UCRL-82269] N79-24479
COAL LIQUEFACTION
Hydropyrolysis of coal derived liquids and related model compounds
N79-24171
Conceptual design for advanced coal liquefaction commercial plant
[FE-2251-52] N79-24182
Analysis of coal hydrogasification processes
[FE-2565-13] N79-24183
Heat transfer simulation in underground coal liquefaction
N79-24292
COASTAL PLAINS
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816
COASTAL WATER
Protection, cleanup and restoration of salt marshes endangered by oil spills: A procedural manual
[PB-291958/7] N79-24522
COATING
Ion beam sputter deposition of fluoropolymers
[NASA-CASE-LEW-13122-1] N79-24154
COATINGS
Materials and techniques for spacecraft static charge control 2
N79-24034
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112
COBALT
Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853
COBALT ALLOYS
Superalloys, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0220/8] N79-24139
COBALT COMPOUNDS
Nuclear magnetic studies of triethylborane with cobalt and nickel compounds
N79-24116
CODING
Comparison of NASCAP predictions with experimental data
N79-24013
Direct sequence spread spectrum signalling
N79-24205
Feedback communications using coding in the forward link
N79-24209
New fidelity criteria for discrete-time source encoding
[AD-A065802] N79-24218
COHERENCE COEFFICIENT
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240
COKE
Analysis of coke combustion during in-situ oil recovery
N79-24095
COLD PRESSING
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128
COLLOIDS
Studies in the theory and practices of foam flotation techniques
N79-24077
COLORADO
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429
Evaluation and prediction of avalanche hazard, San Juan Mountains, Colorado
[PB-290854/9] N79-24594
COLORIMETRY
Rapid method for determining free formaldehyde in phenol-formaldehyde resins
[BLL-RTS-11594] N79-24144
COMBINATORIAL ANALYSIS
Algorithmic and computer code developments for combinatorial and network problems
N79-24679
COMBUSTION
The combustion of organic polymeric materials. Ignition properties
[AD-A065967] N79-24162
COMBUSTION CHAMBERS
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system --- for gas turbine engines
[NASA-TM-79154] N79-23965
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343
The 1.11 new considerations on the development of vortex ports --- for small capacity direct injection engine
[BLL-RTS-11759] N79-24347

COMBUSTION EFFICIENCY
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Two-stage supercharger sets: Efficiency and head distribution under full- and part-load conditions
[RTS-11613] N79-24342
COMBUSTION PHYSICS
Analysis of coke combustion during in-situ oil recovery
N79-24095
Investigations into mixture preparation and combustion in the hydrogen engine
[BLL-RTS-11807] N79-24346
COMBUSTION STABILITY
Preliminary investigation of the nonsteady combustion and flow processes of the Naval Academy Heat Balanced Engine [NAHBE]
[AD-A066085] N79-24101
Solid propellant combustion mechanism research
[AD-A065761] N79-24173
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174
COMBUSTION TEMPERATURE
Sensitivity of burning rate to initial temperature for a binary magnesium-sodium nitrate mix
[AD-A066119] N79-24175
COMMAND AND CONTROL
Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957
COMMERCIAL ENERGY
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489
Solar energy commercialization for European countries, volume 2
[HCP/CS-4250-VOL-2] N79-24493
COMMUNICATION
Feedback communications using coding in the forward link
N79-24209
COMMUNICATION CABLES
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
COMMUNICATION NETWORKS
Routing to minimize the maximum congestion in a communication network
[AD-A066110] N79-24225
Communication complexity of distributed shortest path algorithms
[AD-A066152] N79-24237
Interlisp-11
[AD-A066142] N79-24675
An Evaluation of optional timing/synchronization features to support selection of an optimum design for the DCS digital communication network
N79-24748
Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network
N79-24749
COMMUNICATION SATELLITES
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053
Comparison of signal scintillation models
[AD-A066102] N79-24227
COMMUNICATIONS TECHNOLOGY SATELLITE
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999
Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes [CTS] satellite
N79-24755
COMMUNITIES
Research needs for community water management
[PB-291938/9] N79-24905
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910
COMPOSITE MATERIALS
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061
An evaluation of stiffness reduction as a damage parameter and criterion for fatigue failure in composite materials
N79-24063
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Investigation and characterization of constraint effects on flaw growth during fatigue loading of composite materials
[NASA-CR-158659] N79-24067
Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071
COMPOSITE STRUCTURES
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031
New optical waveguide devices using periodic and chirped surface corrugations and optical waves in periodic layered structures
N79-24820
COMPRESSED AIR
Preliminary long-term stability criteria for compressed air energy storage caverns in salt domes
[PNL-2871] N79-24487
Design of optimum compressed air energy storage systems
[CONF-7811101-1] N79-24508
COMPRESSIBILITY EFFECTS
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343
COMPRESSION LOADS
Flexural vibrations of annular plates under uniform inplane compressive forces --- using Rayleigh-Ritz method
N79-24375
COMPRESSOR BLADES
Fabrication of J79 boron/aluminum compressor blades
[NASA-CR-159566] N79-23970
COMPRESSORS
Test and evaluation of MAKO high-pressure breathing air compressor KA-51-DF
[AD-A065553] N79-24353
COMPUTATION
Computational design alternatives with microprocessor-based systems
N79-24664
Robust stability of linear systems: Some computational considerations
[NASA-CR-158620] N79-24695
Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821
COMPUTER ASSISTED INSTRUCTION
LHC-PILOT, system guide
[PB-291986/8] N79-24677
COMPUTER COMPONENTS
Translations on USSR science and technology: Physical sciences and technology, no. 66
[JPRS-73337] N79-24941
Microprocessors and LSI microprocessor sets as the component base of modern digital systems
N79-24942
COMPUTER DESIGN
A system for incrementally designing and verifying programs
N79-24669
COMPUTER GRAPHICS
Logic circuit simulation and automatic fabrication
[BDX-613-2070-REV] N79-24278
Transient thermoregulatory model with graphics output
[NASA-CR-160217] N79-24637
Finite element grid optimization with interactive computer graphics
N79-24692
COMPUTER NETWORKS
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Communication complexity of distributed shortest path algorithms
[AD-A066152] N79-24237
Algorithmic and computer code developments for combinatorial and network problems
N79-24679
COMPUTER PROGRAMMING
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recover from small ships. Volume 2: Appendices
[AD-A066173] N79-23955
SABAB: A program for calculating satellite ephemerides
[REPT-10-78] N79-23993
Development of measurement techniques for monitoring chemical purity of materials used in digital IC processing
[PB-291427/3] N79-24199
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359
On isochronous derivatives of the first and second order in space dynamics tasks
[NASA-TM-75617] N79-24694
Generation of non-homogeneous poisson processes by thinning: Programming considerations and comparison with competing algorithms
[AD-A066345] N79-24719
COMPUTER PROGRAMS
Investigation of medium and high temperature phase change materials
[NASA-TM-75398] N79-24097
Development of a modular software system for the dynamic simulation of coal conversion plants
[FE-2338-10] N79-24176
Numerical model development for laser cavity flowfields --- subroutine package for a variety of gas dynamics problems
[AD-A065836] N79-24336
Theoretical modeling of molecular and electron kinetic processes. Volume 1: Theoretical formulation of analysis and description of computer program
[AD-A066155] N79-24337
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338
Evaluation of SHABERTH: A bearing simulation computer program
[NASA-CR-161205] N79-24349
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings
[AD-A065554] N79-24355
Dynamic structural analysis with substructures
[AD-A065937] N79-24378
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers --- solving the heat transfer problem
[NASA-CR-158640] N79-24466
A suite of programs for handling ionospheric data
[PEL-REPORT-628] N79-24566
Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567
Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610
Documentation of software in the OL-192 meteorological data reduction program
[AD-A066218] N79-24614
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627
Fluid and Electrolyte Balance model [FEB]
[NASA-CR-160206] N79-24633
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
Computer resource performance management A total data centre approach
[CSIR-TWISK-54] N79-24665
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program --- for the space shuttle orbiter
[NASA-CR-160178] N79-24672
Interlisp-11
[AD-A066142] N79-24675
Linear least squares regression algorithm: NMGS2
[PB-290475/3] N79-24678
Life games: Statistical, deterministic and computer approaches in physics
N79-24721
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775
A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892
COMPUTER STORAGE DEVICES
Advanced archival memory
[AD-A066298] N79-24667
Bipolar dynamic memory cells
N79-24943
COMPUTER SYSTEMS DESIGN
Turbine design system
[AD-A066092] N79-23974
COMPUTER SYSTEMS PROGRAMS
A system for incrementally designing and verifying programs
N79-24669
COMPUTER TECHNIQUES
Data compression: Methods and complexity issues
N79-24662
COMPUTERIZED DESIGN
Wing-mounted antenna code: User's manual
[AD-A065589] N79-24216
Logic circuit simulation and automatic fabrication
[BDX-613-2070-REV] N79-24278
ANALYZE: Analysis of aerospace structures with membrane elements
[AD-A065633] N79-24379
COMPUTERIZED SIMULATION
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0312/3] N79-23959

Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963
Evaluation of SHABERTH: A bearing simulation computer program
[NASA-CR-161205] N79-24349
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers --- solving the heat transfer problem
[NASA-CR-158640] N79-24466
Determination of earthquake source characteristics by computer simulation of teleseismic P-wave pulses N79-24559
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643
The application of sensitivity analysis to models of large scale physiological systems
[NASA-CR-160228] N79-24645
Computer image generation: Improved edge utilization study
[AD-A065640] N79-24673
Simulation study of self-tuning control laws
[OUEL-1201/77] N79-24683
Numerical simulation of spherically symmetric matter in relativity N79-24883
Collisionless galaxy simulations
[NASA-RP-1037] N79-24921

COMPUTERS
Some new airfoils N79-23896
Production, utilization of computer technology in national economy N79-24947

CONCENTRATION [COMPOSITION]
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
Rapid method for determining free formaldehyde in phenol-formaldehyde resins
[BLL-RTS-11594] N79-24144
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521
A study of ozone concentrations in Southern Louisiana
[PB-291823/3] N79-24598
Hydrogen depth profiling using elastic recoil detection --- using helium ions
[SAND-79-0210C] N79-24878
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935

CONCENTRATORS
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511

CONCENTRIC CYLINDERS
Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks N79-24738

CONDENSATES
A semiempirical approach for resonance Raman intensities N79-24078

CONDUCTIVE HEAT TRANSFER
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308
Diffusion and heat transfer in a plane horizontal film
[REPT-77-2] N79-24309

CONES
Roll-damping derivative calculations for spinning sharp and blunt cones in supersonic and hypersonic flow
[AD-A065594] N79-23927

CONFERENCES
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
Aircraft icing
[NASA-CP-2086] N79-23912
Technical evaluation report on the 27th Guidance and Control Panel Symposium on the V/STOL Aircraft at Night and in Poor Visibility
[AGARD-AR-142] N79-23946
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277
Thermal Storage Applications Workshop. Volume 1: Plenary Session Analysis
[NASA-CR-158643] N79-24460
Thermal Storage Applications Workshop. Volume 2: Contributed Papers
[NASA-CR-158644] N79-24461
Energy/Environment 3: Proceedings of the 3rd National Conference on the Interagency R and D Program
[PB-290558/6] N79-24535
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911

CONFIGURATION INTERACTION
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments N79-24787

CONGRESSIONAL REPORTS
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925
US civilian space policy
[GPO-42-110] N79-23988
Developing a domestic common carrier telecommunications policy: What are the issues
[PB-290787/1] N79-24249
Impact of solar energy on rural housing
[GPO-31-641] N79-24467
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907

CONICAL BODIES
An investigation on characterizing mutual coupling between tow antenna slots on a cone
[AD-A066330] N79-24234

CONIFERS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411

CONJUGATE POINTS
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240

CONJUGATES
Phase conjugation method and apparatus for an active retrodirective antenna array
[NASA-CASE-NPO-13641-1] N79-24210

CONSERVATION LAWS
On the mathematical formulation of the first principle of thermodynamics for non-uniform temperature processes
[OUEL-1251/78] N79-24887

CONSTITUTIVE EQUATIONS
Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607

CONSTRAINTS
A convergence proof for constrained finite element solutions
[OUEL-1223/77] N79-24707
Unitarity constraints on meson-nucleon helicity-flip amplitudes and slope of the diffraction peak
[PM/78/7] N79-24802

CONSTRUCTION INDUSTRY
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925

CONSTRUCTION MATERIALS
Coefficients of friction between calcareous sands and some building materials, and their significance
[AD-A066297] N79-24198
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202
Vibration characteristics of walls and a plate glass window representative of those of a wood-frame house
[NASA-TP-1447] N79-24372

CONTACT POTENTIALS
On the axisymmetric contact of closely conforming elastic bodies N79-24364

CONTACT RESISTANCE
The effect of carbon monoxide and methane on the resistance of tin oxide thin films N79-24256
Contaminant identification for an electromechancal unit
[BDX-613-2116-REV] N79-24279

CONTAMINANTS
Contaminant identification for an electromechancal unit
[BDX-613-2116-REV] N79-24279
Chemicals identified in human biological media, a pilot literature survey
[PB-290696/7] N79-24649

CONTAMINATION
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158

CONTINENTAL SHELVES
Physical properties of sediments from the continental margin of western Africa N79-24555
Results of the geoscientific investigations from the VALDIVA cruise VA-10/1975 off Western Africa
[BMFT-FB-M-78-03] N79-24592

CONTINUUM FLOW
A marching method for calculating line and continuum radiation in high energy flow fields
[NASA-CR-3046] N79-24302

CONTINUUM MECHANICS
Continuum absorption coefficient of atoms and ions
[NASA-CR-158536] N79-24791

CONTRACT MANAGEMENT
Evaluation of computer aided indexing of information for support of contract appeals
[AD-A065835] N79-24893

CONTROL
Simulation and control of advanced wastewater treatment systems N79-24895
Research shows ways to facilitate introduction of ASU's N79-24948

CONTROL BOARDS
Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957

CONTROL EQUIPMENT
Feasibility study of the application of self-tuning controllers to chemical batch reactors --- temperature control
[OUEL-1248/78] N79-24326

CONTROL SIMULATION
Minimum variance control, estimation and simulation of nonlinear models of wastewater treatment systems
[OUEL-1214/77] N79-24902

CONTROL THEORY
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
An interactive classical control design algorithm for multivariable systems in state-space form N79-24670
Digital system theory
[AD-A065764] N79-24681
Simulation study of self-tuning control laws
[OUEL-1201/77] N79-24683
Minimum variance control, estimation and simulation of nonlinear models of wastewater treatment systems
[OUEL-1214/77] N79-24902

CONTROLLABILITY
Precision controllability of the F-15 airplane
[NASA-TM-72861] N79-23979

CONTROLLED FUSION
Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832
Tokamak physics: The 70th birthday of L. A. Artsimovich [25 February 1909 to 1 March 1973] N79-24944

CONVECTION CURRENTS
Convective electric field measurements in an auroral plasma N79-24552
A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems N79-24553

CONVECTIVE FLOW
An experimental investigation of the natural convection boundary layer over a uniform flux inclined surface N79-24294

CONVECTIVE HEAT TRANSFER
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. Appendix E: Program listing
[NASA-CR-158632] N79-24296
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. A user's manual with examples
[NASA-CR-158631] N79-24297

CONVERGENCE
A convergence proof for constrained finite element solutions
[OUEL-1223/77] N79-24707
Adaptive observers and controllers with an arbitrarily fast exponential rate of convergence N79-24722

COOLING SYSTEMS
Prototype solar heating and cooling systems
[NASA-CR-161204] N79-24437

Optimum combinations of cooling alternatives for stream-electric power plants, volume 2
[PB-290576/8] N79-24515
COPPER
Studies in the theory and practices of foam flotation techniques
N79-24077
COPPER ALLOYS
A study to determine the mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater
[AD-A066257] N79-24130
COPPER COMPOUNDS
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277
COPPER OXIDES
Cuprous oxide photovoltaic cells --- fabricating schottky barrier devices
[PB-290529/7] N79-24514
Investigation of low cost solar cells based on Cu2O
[PB-290940/6] N79-24516
CORE SAMPLING
Investigations of sediment cores from the central Pacific SE of Hawaii from the VALDIVIA cruise 13/1
[BMFT-FB-M-77-08] N79-24624
CORN
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
CORRELATION
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations
N79-24810
CORRELATION COEFFICIENTS
Existence and uniqueness of positive solutions of a nonlinear integral solutions of a nonlinear integral solution
N79-24685
CORROSION
Simple acoustic emission tests for the detection of corrosion
[AD-A065965] N79-24122
A study to determine the mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater
[AD-A066257] N79-24130
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
Corrosion of stainess steel, volume 2. A bibliography with abstracts
[NTIS/PS-79/0208/3] N79-24143
Deleterious effect of MIL-F-14256, type RA fluxes on printed wiring boards
[AD-A066129] N79-24274
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474
CORRUGATING
A study of grating filters in thin-film optical waveguides
N79-24819
New optical waveguide devices using periodic and chirped surface corrugations and optical waves in periodic layered structures
N79-24820
COSMOLOGY
Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916
COST ANALYSIS
Avionics standardization potential analysis
[AD-A066138] N79-23958
Conceptual design for advanced coal liquefaction commercial plant
[FE-2251-52] N79-24182
Optimal beam layouts: Allowance for cost of shear
[ISD-237] N79-24389
Solar project cost report: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/60] N79-24482
Solar project cost report: Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/60] N79-24483
Solar project cost report: Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/60] N79-24484
Solar project cost report. Iris Images, Incorporated, Film Laboratory, Mill Valley, California
[SOLAR/2005-78/60] N79-24494
Solar project cost report. Aratex Services, Inc., Industrial Laundry, Fresno, California
[SOLAR/2008-78/60] N79-24495
Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network
N79-24749
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
COST EFFECTIVENESS
Reliability trade-offs for unit production cost
[AD-A065643] N79-24360
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904
COST ESTIMATES
The production function and airframe cost estimation
[AD-A065570] N79-23952
COSTS
Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
COUNTERS
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2
N79-24056
Electrochemical detection device --- for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073
COUPLING
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
Ionspheric electrodynamics and its coupling to the magnetosphere
N79-24549
Auroral magnetosphere-ionosphere coupling: A brief topical review
[NASA-CR-158662] N79-24572
Coupling of electronic and vibrational motions in molecules
N79-24790
Multi-Regge factorization in inclusive two-particle production
[ILL-[TH]-79-14] N79-24793
COVERINGS
Loaded shells with rigid mantels
[ISD-227] N79-24385
Types of karst, with emphasis on cover beds in their classification and development
N79-24556
CRACK INITIATION
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
CRACK PROPAGATION
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Investigation and characterization of constraint effects on flaw growth during fatigue loading of composite materials
[NASA-CR-158659] N79-24067
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395
CRACKING [FRACTURING]
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
Stress crack phenomena volume 3. A bibliography with abstracts
[NTIS/PS-79/0269/5] N79-24403
Stress crack phenomena volume 4. A bibliography with abstracts
[NTIS/PS-79/0270/3] N79-24404
CRACKS
Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371
CRITICAL LOADING
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
CRITICAL POINT
The effects of finite size on the critical behavior of fluid films
N79-24288
Consequences of the renormalization group for the thermodynamics of fluids near the critical point
N79-24884
CRITICAL TEMPERATURE
High-temperature series expansion for the singlet-triplet model
N79-24864
CROP GROWTH
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
CROP INVENTORIES
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
CROSS CORRELATION
Comparative study of phase curves obtained by different methods for estimating cross spectral density. Geographic applications: Measure of phase shift and delay of PC 1 signals
[CEPHAG-4/78] N79-24243
CROSS FLOW
Mechanisms of particle transport and electro-kinetic phenomena in a cross flow/electrofilter
N79-24088
CROSS SECTIONS
Differential cross section measurements for electron impact on barium in ground and laser excited states
N79-24785
CROSSED FIELD AMPLIFIERS
CFA design improvement program. Volume 1: Instrumented CFA studies
[AD-A065735] N79-24262
CFA design improvement program. Volume 2: Computer modeling studies
[AD-A065736] N79-24263
CROSSLINKING
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164
CRUCIBLES
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470
CRUCIFORM WINGS
Supersonic flow in the area of antisymmetric thin cruciform wings with supersonic leading edges in a horizontal plane, with consideration of flow separation on the edges
[AD-A065993] N79-23929
CRUDE OIL
Analysis of coke combustion during in-situ oil recovery
N79-24095
US refining capacity: How much is enough
[PB-291437/2] N79-24192
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
Control of volatile organic emissions from petroleum liquid storage in external floating roof tanks
[PB-290579/2] N79-24537
CRYOGENIC EQUIPMENT
The design, construction and calibration of a research cold room complex
[CSIR-ME-1577] N79-23983
CRYSTAL FILTERS
Inductorless narrow-band filter/amplifier
[NASA-CASE-GSC-12410-1] N79-24260
CRYSTAL GROWTH
Polymerization of sicica in aqueous solutions
N79-24149
LSA Large area Silicon sheet task continuous Czochralski process development
[NASA-CR-158675] N79-24451
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470
Laser-zone growth in a Ribbon-to-Ribbon [RTR] process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473
CRYSTAL LATTICES
Research on lattice-mismatched semi-conductor layers --- AlGaAsSb systems
[SAN-1250-4] N79-24880
CRYSTAL OSCILLATORS
Composite oscillator systems for meeting user needs for time and frequency
N79-24733

Relationships between the performance of time/frequency standards and navigation/communication systems
N79-24734
Acceleration sensitivity compensation in high performance crystal oscillators
N79-24735
Quartz crystal and superconductive resonators and oscillators
N79-24737

CRYSTAL STRUCTURE
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
Local site distortion model of magnetostriction
[AD-A066250] N79-24763
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition
N79-24788

CRYSTAL SURFACES
Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853

CRYSTALLIZATION
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295

CRYSTALLOGRAPHY
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764
Structure analyses of organic compounds using X-ray crystallographic techniques
N79-24851

CULTURE TECHNIQUES
Electrochemical detection device --- for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073

CUMULUS CLOUDS
Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582

CURRENT REGULATORS
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257

CURVATURE
A test of curvature elasticity above the nematic-smectic A phase transition
N79-24859

CYBERNETICS
Introduction to systems approach
N79-24732

CYCLES
Radioactive waste disposal: A comparison of alternative nuclear fuel cycles
N79-24812

CYCLIC COMPOUNDS
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin
N79-24868

CYCLIC LOADS
The fatigue of Ti6Al4V alloy in coarse and fine structural conditions under fully reverse loading as well as pulsating tension
N79-24119
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395

CYCLONES
Tropical cyclone strike probability forecasting
[AD-A065545] N79-24611

CYCLOTRON FREQUENCY
High power millimeter wave amplifier
[AD-A062966] N79-24275

CYCLOTRON RESONANCE
Interactions of relativistic charged particle beams
[AD-A066045] N79-24814

CYLINDRICAL BODIES
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
Heat transfer simulation in underground coal liquefaction
N79-24292

CYLINDRICAL CHAMBERS
Superfluid 3He in narrow cylinders --- nuclear magnetic resonance
N79-24873

CYLINDRICAL SHELLS
Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks
N79-24738

CYTOLOGY
Cytochemical study related to laser application
[AD-A065671] N79-24335

CZECHOSLOVAKIA
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938
Experiments of USSR-CSSR cosmic flight described
N79-24939

CZOCHRALSKI METHOD
LSA Large area Silicon sheet task continuous Czochralski process development
[NASA-CR-158675] N79-24451

D

DAMPERS
Performance of two-stage fan with larger dampers on first-stage rotor
[NASA-TP-1399] N79-23967

DAMPERS [VALVES]
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497

DAMPING
Roll-damping derivative calculations for spinning sharp and blunt cones in supersonic and hypersonic flow
[AD-A065594] N79-23927
Conference on Aerospace Polymeric Viscoelastic Damping Technology for 1980's
[AD-A065518] N79-24157
Development of procedures for calculating stiffness and damping of elastomers in engineering applications. Part 5: Elastomer performance limits and the design and test of an elastomer damper
[NASA-CR-159552] N79-24373
Coupled nonlinear Schroedinger equations including growth and damping
[CTH-IEFT/PP-1977-14] N79-24847

DATA ACQUISITION
Investigation of medium and high temperature phase change materials
[NASA-TM-75398] N79-24097
Seismic discrimination
[AD-A065574] N79-24578
Operating manual for the RRL 8 channel data logger
[NASA-CR-158633] N79-24671
An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889

DATA BASES
Geographical information systems: A review
[PB-290748/3] N79-24424
Computer resource performance management A total data centre approach
[CSIR-TWISK-54] N79-24665
A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892

DATA COMPRESSION
New fidelity criteria for discrete-time source encoding
[AD-A065802] N79-24218
Data compression: Methods and complexity issues
N79-24662

DATA CORRELATION
Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615

DATA LINKS
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Routing to minimize the maximum congestion in a communication network
[AD-A066110] N79-24225

DATA MANAGEMENT
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930

DATA PROCESSING
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
Instrumentation and data processing used in Earth Resources Technology Satellites [ERTS], volume 2. A bibliography with abstracts
[NTIS/PS-79/0206/7] N79-24430
Multimode CPU design study
[AD-A066241] N79-24666
Investigation of micropulsation activity
[AD-A066344] N79-24668
A contemporary approach to the problem of determining physical parameters according to the results of measurements
[NASA-TM-75616] N79-24696
Translations on USSR science and technology: Physical sciences and technology, no. 67
[JPRS-73388] N79-24946

DATA RECORDING
Digital recording using hologram arrays: Laser-beam deflection and modulation
[BBC-RD-1979/6] N79-24320

DATA REDUCTION
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
Atmospheric refraction measurements and related efforts
[AD-A065766] N79-24574
Documentation of software in the OL-192 meteorological data reduction program
[AD-A066218] N79-24614
Construction of integral quadratic forms
N79-24691
Identification and order reduction of dynamical systems
N79-24723

DATA SAMPLING
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410

DATA STORAGE
Advanced archival memory
[AD-A066298] N79-24667

DATA SYSTEMS
A suite of programs for handling ionospheric data
[PEL-REPORT-628] N79-24566
A rocket-borne data-manipulation experiment using a microprocessor
[NASA-CR-158647] N79-24571

DATA TRANSMISSION
Communications technology forecast
[PB-292697/0] N79-24252

DECISION MAKING
Further theory of stable decisions
N79-24710
Inference and decision making based on interval-valued probability
N79-24717
An investigation of a human information processing model for decision making
[AD-A065912] N79-24890
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891

DECOMPOSITION
A refinement of Lebesgue's measure decomposition
[CTH-MATH-1978-1] N79-24728

DEEP SPACE
PTTI applications to deep space navigation
N79-24759

DEFECTS
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163

DEFENSE PROGRAM
Development of an airborne military system [MRCA system]
[MBB-UFE-1322-O] N79-23904
Energy Materials Coordinating Committee [EMACC]
[DOE/US-002] N79-24490

DEGRADATION
Stability and degradation of superconducting current-carrying devices
[LA-7275] N79-24879

DEGREES OF FREEDOM
On large displacement-small strain analysis of structures with rotational degrees of freedom
[ISD-247] N79-24392

DEMAND [ECONOMICS]
The impact of telecommunication on transportation demand through the year 2000
[PB-290833/3] N79-24246

DENDRITIC CRYSTALS
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453

DENMARK
Space research in Denmark
N79-24937

DENSIFICATION
Densified biomass: A new form of solid fuel
[SERI-35] N79-24180

DEPTH
Hydrogen depth profiling using elastic recoil detection --- using helium ions
[SAND-79-0210C] N79-24878

DESALINIZATION
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110

DESIGN ANALYSIS
A method for deriving statistical parameters for design against random stresses resulting from working operations
[LFB-FB-135] N79-24402
Computational design alternatives with microprocessor-based systems
N79-24664

DESULFURIZING
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120

DETECTION
Development of sensitized pick coal interface detector system
[NASA-CR-161225] N79-24417

DETONATION WAVES
Stability and amplification of shock waves
[AD-A066108] N79-24305

DEUTERIDES
Microstructural study of V2D by X-ray measurements
N79-24854

DIAGNOSIS
Diagnostics of wear in aeronautical systems
[NASA-TM-79185] N79-24350

DIAGRAMS
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608

DIAMONDS
Metallic xenon
N79-24118

DIATOMIC MOLECULES
Collision induced dissociation of diatomic molecules
[AD-A066191] N79-24798

DIELECTRIC PROPERTIES
Model for breakdown process in dielectric discharges
N79-24044
Stable dielectric charge distributions from field enhancement of secondary mission
N79-24046
Dielectric measurements of five different soil textural types as functions of frequency and moisture content
[PB-291944/7] N79-24595

DIELECTRICS
Electron transport model of dielectric charging
N79-24018
Charging rates of metal-dielectric structures --- with implications for spacecraft
N79-24033
Materials and techniques for spacecraft static charge control 2
N79-24034
Electric fields in irradiated dielectrics
N79-24035
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control
N79-24040
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
N79-24204
Diffraction by a dielectric wedge
[AD-A065699] N79-24762

DIES
Transistor screening evaluation SJ6708H
[NASA-CR-161234] N79-24258
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470

DIESEL ENGINES
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343

DIFFERENCE EQUATIONS
An implicit algorithm for the conservative, transonic full-potential equation with effective rotated differencing
[NASA-TM-78570] N79-23909
A statistical rationale for relating situational attributes and individual differences
[AD-A066088] N79-24718

DIFFERENTIAL CALCULUS
Numerical calculations of periodic gravity-capillary waves
N79-24287
On isochronous derivatives of the first and second order in space dynamics tasks
[NASA-TM-75617] N79-24694

DIFFERENTIAL EQUATIONS
Relationship between Dirac and matrix Schroedinger inverse scattering transforms
[PM/78/6] N79-24072
Heat transfer simulation in underground coal liquefaction
N79-24292
Generalised displacement functions --- an elastic continuum
[OUEL-1244/78] N79-24399
Bifurcation of periodic solutions in functional differential equations
N79-24684
Nonlinear evolution equations associated with a massive Dirac system
[PM/78/5] N79-24705

DIFFRACTION
High frequency near field scattering by an elliptic disk
[AD-A065586] N79-24214
Diffraction by a dielectric wedge
[AD-A065699] N79-24762

DIFFUSERS
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920

DIFFUSION
Model diffuser investigation for propulsion wind tunnel 16T
[AD-A065822] N79-23984
An impulse control policy for a class of jump diffusion processes
[CSIR-T-WISK-55] N79-24698
Diffusion limit for the transport of quasifree electrons in liquids
[AD-A065679] N79-24795

DIFFUSION THEORY
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308

DIGITAL COMMAND SYSTEMS
Evaluation of a digital helicopter control system --- BO-105 helicopter
[MBB-UFE-1349-O] N79-23980

DIGITAL COMPUTERS
Routing to minimize the maximum congestion in a communication network
[AD-A066110] N79-24225

DIGITAL DATA
Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis
N79-24407

DIGITAL FILTERS
Real-time video filtering with bit-slice microprogrammable processors
N79-24207
Spectral analysis by means of autoregressive filter
[CEPHAG-41/77] N79-24241
Polynomial representations and an iterative procedure for filter realization
N79-24255
Error analysis of digital filters with logarithmic number system
N79-24660

DIGITAL RADAR SYSTEMS
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-(9022.549)]
N79-24602

DIGITAL SIMULATION
Comparison of signal scintillation models
[AD-A066102] N79-24227
Logic circuit simulation and automatic fabrication
[BDX-613-2070-REV] N79-24278

DIGITAL SYSTEMS
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Digital recording using hologram arrays: Laser-beam deflection and modulation
[BBC-RD-1979/6] N79-24320
Spectral characteristics of piecewise polynomial representation of digital signals
N79-24659
Digital system theory
[AD-A065764] N79-24681
New techniques for tracking sequences of digitized images
[AD-A066194] N79-24828
Microprocessors and LSI microprocessor sets as the component base of modern digital systems
N79-24942

DIGITAL TELEVISION
Digital recording using hologram arrays: Laser-beam deflection and modulation
[BBC-RD-1979/6] N79-24320

DIODES
Theory of foil-less diodes
N79-24808

DIRAC EQUATION
Relationship between Dirac and matrix Schroedinger inverse scattering transforms
[PM/78/6] N79-24072
Nonlinear evolution equations associated with a massive Dirac system
[PM/78/5] N79-24705
Neutrinos and long-range weak forces in cosmology
N79-24882

DIRECT CURRENT
Influence of thermal disorder on electronic properties of solids --- direct current conductivity and optical properties
N79-24872

DISASTERS
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999

DISCRETE FUNCTIONS
New fidelity criteria for discrete-time source encoding
[AD-A065802] N79-24218
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236

DISPENSERS
A methodology for an effectiveness analysis of RPV's in a chaff dispensing role
[AD-A065557] N79-23953

DISPERSING
A comparison of theoretical and experimental results in supercooled stratus dispersal
[AD-A063013] N79-24581

DISPLACEMENT MEASUREMENT
Generalised displacement functions --- an elastic continuum
[OUEL-1244/78] N79-24399

DISPLAY DEVICES
Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957
Proximity-vision system for protoflight manipulator arm
[NASA-CR-158652] N79-24658

DISSIPATION
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928

DISSOCIATION
Collision induced dissociation of diatomic molecules
[AD-A066191] N79-24798

DISTORTION
Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969

DISTRIBUTED PARAMETER SYSTEMS
Identification and order reduction of dynamical systems
N79-24723

DISTRIBUTION [PROPERTY]
Global distribution of ozone for various seasons
[NASA-TM-75435] N79-24564

DISTRIBUTION FUNCTIONS
Waiting times and return periods related to order statistics
N79-24708
Bivariate nonparametric tests for the one-sample location problem
N79-24711

DISTRIBUTION MOMENTS
The distribution of maximum wind speed
[BLL-TRANS-1368-(9022.549)]
N79-24601

DISTRICT OF COLUMBIA
An analysis of air pollution and its health effects: Washington, D. C. metropolitan area
[PB-290618/8] N79-24545

DOCUMENT STORAGE
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory --- for the demographic mapping program
[LBL-8707] N79-24894

DOMESTIC ENERGY
Application and system design study for cost-effective solar photovoltaic systems at Federal installations
[HCP/CS-0306] N79-24500

DOSIMETERS
Metal-nitride-oxide-semiconductor detector for an ionizing radiation dosimeter
[AD-A065995] N79-24267

DRAG
Numerical optimization techniques for bound circulation distribution for minimum induced drag of nonplanar wings: Basic formulations
[NASA-CR-3154] N79-23924
Development of analytical orbit propagation technique with drag
[NASA-CR-160176] N79-23992
Some experimental observations of the flow through gauze screens
[ATN-7804] N79-24300
The flow through a gauze screen
[ATN-7801] N79-24301

DRAG CHUTES
Flame nosetip recovery vehicle flight test series
[AD-A066217] N79-24058

DRAG MEASUREMENT
Measurement of the drag of slender cones in hypersonic flow at low Reynolds numbers using a magnetic suspension and balance
[OUEL-1235/78] N79-23938

DRAG REDUCTION
Turbulent boundary layer structure and drag reduction
[AD-A065667] N79-24303

DRAINAGE
Methodologies of examining pollution from urban runoff
[PB-290595/8] N79-24427
Urban water resources policy alternatives: A sociological analysis of differential perspectives
[PB-290583/4] N79-24538

DRAINAGE PATTERNS
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904

DUCTED FANS
Numerical calculation of inviscid transonic flow through rotors and fans
N79-23906
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911

DUCTED FLOW
The flow through a gauze screen
[ATN-7801] N79-24301

DUCTILITY
Evaluating strength and ductility of irradiated zircaloy, task 5
[PB-291511/4] N79-24142

DUNITE
Development of preferred orientation in uniaxially deformed olivine aggregates
N79-24554

DWARF STARS
A magnetic study of the spotted UV Ceti flare stars and related late-type dwarfs
N79-24918

DYNAMIC CHARACTERISTICS
Dynamics of a continuous thickener handling a compressible slurry
N79-24083
Convergence of non-ergodic dynamic systems --- non-interfacing particles
[CTH-MATH-1977-18] N79-24720
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932

DYNAMIC MODELS
Dynamics of a continuous thickener handling a compressible slurry
N79-24083
General-equilibrium approach to energy/environmental economic analysis
[BNL-24781] N79-24504
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627
On isochronous derivatives of the first and second order in space dynamics tasks
[NASA-TM-75617] N79-24694
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation
N79-24896
Minimum variance control, estimation and simulation of nonlinear models of wastewater treatment systems
[OUEL-1214/77] N79-24902

DYNAMIC RESPONSE
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings
[AD-A065554] N79-24355
Large deflection response of elastic/visco-plastic beams under combined tension and bending
N79-24366
Some observations on the random response of linear and nonlinear dynamical systems
[PB-290808/5] N79-24596
Structural and dynamic considerations in molecular collision theory
[AD-A065531] N79-24794

DYNAMIC STABILITY
Technical evaluation report on the Fluid Dynamics Panel Symposium on Dynamic Stability parameters
[AGARD-AR-137] N79-23981

DYNAMIC STRUCTURAL ANALYSIS
Aircraft sonic boom: Effects on buildings. A bibliography with abstracts
[NTIS/PS-79/0265/3] N79-24201
Large deflection response of elastic/visco-plastic beams under combined tension and bending
N79-24366

E

EARTH CRUST
Recent vertical crustal movements from leveling observations in the Rio Grande rift: A review
[LA-UR-78-3195] N79-24589

EARTH ENVIRONMENT
Down to earth relativity
N79-24753

EARTH MANTLE
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. Appendix E: Program listing
[NASA-CR-158632] N79-24296
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. A user's manual with examples
[NASA-CR-158631] N79-24297

EARTH ORBITS
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023

EARTH ROTATION
Modern methods for the determination of polar motion and UT1
N79-24754

EARTH SATELLITES
Evolution of the rotation of an artificial earth satellite under the influence of a perturbing moment which is constant in fixed axes
[NASA-TM-75614] N79-23995

EARTHQUAKE RESISTANT STRUCTURES
Earthquake hazards reduction: Issues for an implementation plan
[PB-290467/0] N79-24593

EARTHQUAKES
Generalized ray models of strong ground motion
N79-24557
Determination of earthquake source characteristics by computer simulation of teleseismic P-wave pulses
N79-24559
Earthquake hazards reduction: Issues for an implementation plan
[PB-290467/0] N79-24593

ECOLOGY
Stream channel modification in Hawaii, part A: Statewide inventory of streams, habitat factors and associated biota
[PB-290571/9] N79-24425

ECONOMETRICS
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489

ECONOMIC ANALYSIS
General-equilibrium approach to energy/environmental economic analysis
[BNL-24781] N79-24504
Method for the comparative economic assessment of energy storage systems
[BNL-25291] N79-24509
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives --- economic analysis
N79-24813

ECONOMIC IMPACT
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429
The economic impact analysis of effluent standards for total dissolved solids
[PB-290916/6] N79-24541

ECONOMICS
Production, utilization of computer technology in national economy
N79-24947

ECONOMY
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory --- for the demographic mapping program
[LBL-8707] N79-24894

ECOSYSTEMS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Environmental development plan for transportation energy conservation. FY 1979 update
[ANL/EES-TM-33] N79-24899

EDGE LOADING
Comparison of accuracies of solutions of linear shell theories for closed circular cylinders under edgewise loading
[NAL-TR-552T] N79-24370
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376

EDITING ROUTINES [COMPUTERS]
A system for incrementally designing and verifying programs
N79-24669

EDUCATION
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527

EFFECTIVE PERCEIVED NOISE LEVELS
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769

EFFLUENTS
Fluid sample collection and distribution system --- qualitative analysis of aqueous samples from several points
[NASA-CASE-MSC-16841-1] N79-24285

EINSTEIN EQUATIONS
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations
N79-24886

ELASTIC BODIES
On the axisymmetric contact of closely conforming elastic bodies
N79-24364
Existence and approximations for saddle-point problems with application to nonlinear incompressible elasticity
N79-24365
Contact phenomena. 1: Stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components
[ESDU-78035] N79-24369
The Boussinesq and Cerruti solutions for a transversely isotropic half-space
[OUEL-1232/78] N79-24397

ELASTIC DEFORMATION
Elastic-plastic torsion of prismatic bars with polygonal cross section
[ETEC-TRANS-1] N79-24384
Generalised displacement functions --- an elastic continuum
[OUEL-1244/78] N79-24399

ELASTIC MEDIA
Generalised displacement functions --- an elastic continuum
[OUEL-1244/78] N79-24399

ELASTIC PLATES
Acoustic emission and propagation of elastic pulses in a plate
N79-24768

ELASTIC PROPERTIES
A test of curvature elasticity above the nematic-smectic A phase transition
N79-24859

ELASTIC SCATTERING
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments
N79-24787
Unitarity constraints on meson-nucleon helicity-flip amplitudes and slope of the diffraction peak
[PM/78/7] N79-24802
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations
N79-24810
Neutron scattering on even isotopes of tin
N79-24870

ELASTIC WAVES
Spectral and scattering inverse problems
[PM/78/1] N79-24394

ELASTOMERS
Mechanisms of rubber abrasion
N79-24151
Development of procedures for calculating stiffness and damping of elastomers in engineering applications. Part 5: Elastomer performance limits and the design and test of an elastomer damper
[NASA-CR-159552] N79-24373

ELASTOPLASTICITY
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386

ELECTRIC ARCS
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2
N79-24056

ELECTRIC AUTOMOBILES
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900

ELECTRIC BATTERIES
Energy storage with ambient temperature rechargeable lithium batteries
[PB-290934/9] N79-24518

ELECTRIC CHARGE
Charging rates of metal-dielectric structures --- with implications for spacecraft
N79-24033

ELECTRIC CONNECTORS
Some thoughts on electrical connections
[PB-290491/0] N79-24282

ELECTRIC CURRENT
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024
Effect of parasitic plasma currents on solar-array power output
N79-24025
The potential recovery of porous graphite fluoride electrodes after termination of the load current
[AD-A065544] N79-24264
ELECTRIC DISCHARGES
Environmental interaction implications for large space systems
N79-24027
Area scaling investigations of charging phenomena -- discharge pulse characteristics of Teflon thermal control tape
N79-24032
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
Electrostatic discharge properties of selected Voyager spacecraft materials
N79-24039
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control
N79-24040
Scaling laws and edge effects for polymer surface discharges
N79-24041
Thermal blanket metallic film groundstrap and second surface mirror vulnerability to arc discharges
N79-24042
Investigation of electrostatic discharge phenomena on conductive and non-conductive solar reflectors
N79-24043
Model for breakdown process in dielectric discharges
N79-24044
The potential recovery of porous graphite fluoride electrodes after termination of the load current
[AD-A065544] N79-24264
Discharge processes in the oxygen plasma
[AD-A066196] N79-24841
ELECTRIC EQUIPMENT TESTS
Transistor screening evaluation SJ6708H
[NASA-CR-161234] N79-24258
ELECTRIC FIELD STRENGTH
Rotational flows in electrically conducting and non-conducting fluids
N79-24289
ELECTRIC FIELDS
Electric fields in irradiated dielectrics
N79-24035
Potential mapping with charged-particle beams
N79-24038
Stable dielectric charge distributions from field enhancement of secondary mission
N79-24046
Convective electric field measurements in an auroral plasma
N79-24552
Summary of airplane electric field measurements as part of ionospheric electric field mapping investigation, Thompson, Manitoba, August 1978
[AD-A066304] N79-24583
Collisionless tearing instabilities
[IPPJ-370] N79-24834
ELECTRIC GENERATORS
Description of photovoltaic village power systems in the United States and Africa
[NASA-TM-79149] N79-24443
Digest of equipment for converting solar, wind, and geothermal energy into electric power for USN application ashore
[AD-A066221] N79-24475
Feasibility and economics of cogeneration in California's thermal enhanced oil recovery operations
[PB-291794/6] N79-24517
ELECTRIC HYBRID VEHICLES
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
ELECTRIC MOTOR VEHICLES
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
ELECTRIC POTENTIAL
ATS-5 and ATS-6 potentials during eclipse
N79-24005
Operations of the ATS-6 ion engine
N79-24007
Characteristics of differential charging of ATS-6
N79-24008
Description and charging results from the RSPM
N79-24010
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024
Potential mapping with charged-particle beams
N79-24038
Parameter dependence of equilibrium charging potentials
N79-24045
ELECTRIC POWER PLANTS
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
Power industry application of MHD technology
N79-24949
ELECTRIC POWER SUPPLIES
A programmable power processor for a 25-cW power module
[NASA-TM-78215] N79-24441
ELECTRIC PROPULSION
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029
ELECTRIC WIRE
Some thoughts on electrical connections
[PB-290491/0] N79-24282
ELECTRICAL ENGINEERING
Translations on USSR science and technology: Physical sciences and technology, no. 66
[JPRS-73337] N79-24941
ELECTRICAL FAULTS
Model for breakdown process in dielectric discharges
N79-24044
Transistor screening evaluation SJ6708H
[NASA-CR-161234] N79-24258
ELECTRICAL INSULATION
Status of materials characterization studies
N79-24030
ELECTRICAL MEASUREMENT
Dielectric measurements of five different soil textural types as functions of frequency and moisture content
[PB-291944/7] N79-24595
ELECTRICAL PROPERTIES
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
Low temperature properties of bismuth films in large electric and magnetic fields
N79-24867
ELECTRICAL RESISTIVITY
Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857
Influence of thermal disorder on electronic properties of solids — direct current conductivity and optical properties
N79-24872
ELECTRICITY
Proceedings of the distribution automation and control working group. Volume 1: Executive summary
[NASA-CR-158642] N79-24259
Translations on USSR science and technology: Physical sciences and technology, no. 67
[JPRS-73388] N79-24946
ELECTROCHEMICAL CELLS
Thermoelectrochemical cycles for power and hydrogen production
[BNL-24387] N79-24491
ELECTROCHEMISTRY
Electrochemical detection device — for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073
Spectroelectrochemical studies of fast reactions
N79-24082
Mass transfer and kinetic studies on rotating electrodes
N79-24091
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445
ELECTRODELESS DISCHARGES
Optimization and application of microwave-excited discharges
N79-24830
ELECTRODEPOSITION
Nickel coatings achieved without the use of electric current
[BLL-RTS-11605] N79-24113
Electrodeposition painting of metal substrates: Pinholing in surface films
[AD-A065968] N79-24160
ELECTRODES
Mass transfer and kinetic studies on rotating electrodes
N79-24091
The potential recovery of porous graphite fluoride electrodes after termination of the load current
[AD-A065544] N79-24264
ELECTRODYNAMICS
Ionspheric electrodynamics and its coupling to the magnetosphere
N79-24549
ELECTROLYTE METABOLISM
Fluid and Electrolyte Balance model [FEB]
[NASA-CR-160206] N79-24633
ELECTROLYTIC CELLS
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440
ELECTROMAGNETIC ABSORPTION
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781
ELECTROMAGNETIC COMPATIBILITY
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
ELECTROMAGNETIC FIELDS
An analysis of the mutual coupling between antennas on a smooth convex surface
[AD-A065591] N79-24211
Electromagnetic fields in nonuniform multi-layered structures with engineering applications
[AD-A065515] N79-24228
Antennas and the associated time domain range for the measurement of impulsive fields
[PB-291733/4] N79-24253
The magnetic induction of the system consisting of a coil and a ferromagnetic spherical body
[AD-A065809] N79-24266
ELECTROMAGNETIC NOISE
Noise performance of broadband amplifiers for use with electrically small antennas
N79-24208
Interpretation of enhanced laser-plasma backscattering due to prepulse radiation
N79-24340
Frequency domain measurement systems
N79-24744
ELECTROMAGNETIC PULSES
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2
N79-24056
Development of pulsed processes for the manufacture of solar cells
[NASA-CR-158676] N79-24450
ELECTROMAGNETIC RADIATION
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055
Experimental laser anemometry and analysis of electromagnetic waves in moving media
N79-24328
New optical waveguide devices using periodic and chirped surface corrugations and optical waves in periodic layered structures
N79-24820
ELECTROMAGNETIC SCATTERING
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
N79-24204
High frequency near field scattering by an elliptic disk
[AD-A065586] N79-24214
An asymptotic result for the scattering of a plane wave by a smooth convex cylinder
[AD-A065588] N79-24229
Diffraction by a dielectric wedge
[AD-A065699] N79-24762
ELECTROMECHANICAL DEVICES
Contaminant identification for an electromechancal unit
[BDX-613-2116-REV] N79-24279
ELECTRON ACCELERATORS
Further development of the multipactor discharge electron source
N79-24057
ELECTRON BEAM WELDING
Application of electron-beam welding to aviation production --- tests of turbine engine parts welded by electron beam
N79-24940
ELECTRON BEAMS
Electron beam semiconductor devices. Citations from the NTIS data base
[NTIS/PS-79/0142/4] N79-24280
Electron beam semiconductor devices. Citations from the Engineering Index data base
[NTIS/PS-79/0143/2] N79-24281
Theory of foil-less diodes
N79-24808
Interactions of relativistic charged particle beams
[AD-A066045] N79-24814
ELECTRON DENSITY PROFILES
Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835
ELECTRON DISTRIBUTION
Distribution of positive ion species above a diffuse midnight aurora
N79-24550
ELECTRON ENERGY
Anomalous plasma transport due to electron temperature gradient instability
[IPPJ-369] N79-24833

ELECTRON FLUX DENSITY
The photoelectron flux in the earth's ionosphere at energies in the vicinity of photoionization peaks
[AD-A062310] N79-24580
ELECTRON GUNS
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
Further development of the multipactor discharge electron source
N79-24057
ELECTRON IRRADIATION
Electron transport model of dielectric charging
N79-24018
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031
Electric fields in irradiated dielectrics
N79-24035
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
Skynet satellite electron precharging experiments
N79-24037
Collisionless evolution of the auroral electron velocity distribution function
N79-24548
ELECTRON MICROSCOPY
High resolution electron microscopy of sulfides
N79-24863
ELECTRON PLASMA
Fluctuations in active molecular plasmas
[CTH-IEFT/PP-1978-1] N79-24849
ELECTRON SCATTERING
Differential cross section measurements for electron impact on barium in ground and laser excited states
N79-24785
ELECTRON STATES
Local electronic properties of dilute magnetic alloys
N79-24114
Excimer potential curves
[AD-A066043] N79-24332
ELECTRON TRANSFER
On the correlation of the kinetics of electron transfer processes with the change in reaction free energy. Application to electron-exchange initiated chemiluminescence reactions
[AD-A066342] N79-24105
Theory of foil-less diodes
N79-24808
ELECTRON TRANSITIONS
Theoretical modeling of molecular and electron kinetic processes. Volume 1: Theoretical formulation of analysis and description of computer program
[AD-A066155] N79-24337
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338
ELECTRON TUBES
CFA design improvement program. Volume 1: Instrumented CFA studies
[AD-A065735] N79-24262
CFA design improvement program. Volume 2: Computer modeling studies
[AD-A065736] N79-24263
ELECTRON TUNNELING
Cylindrical Josephson tunneling
N79-24871
ELECTRONIC CONTROL
An electric control for an electrohydraulic active control aircraft landing gear
[NASA-CR-3113] N79-23948
ELECTRONIC EQUIPMENT
JSEP achievements 1961-1978 [update of 15-year report dated September 1976]
[AD-A065670] N79-24271
ELECTRONIC MODULES
Module failure isolation circuit for paralleled inverters --- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
ELECTRONIC PACKAGING
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
ELECTROPHYSIOLOGY
The effects of high nitrogen tensions of the properties of neuronal membranes and synaptic transmission
[AD-A063856] N79-24647
ELECTROPOLISHING
Measurement of the thermal emission of tungsten and analysis of electron relaxation effects
N79-24866
ELECTROSTATIC CHARGE
ATS-5 and ATS-6 potentials during eclipse
N79-24005
Characteristics of differential charging of ATS-6
N79-24008
Materials and techniques for spacecraft static charge control 2
N79-24034
Skynet satellite electron precharging experiments
N79-24037
Electrostatic discharge properties of selected Voyager spacecraft materials
N79-24039
Investigation of electrostatic discharge phenomena on conductive and non-conductive solar reflectors
N79-24043
ELECTROSTATIC PRECIPITATORS
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
ELECTROSTATIC PROBES
A rocket-borne electrostatic analyzer for measurement of energetic particle flux
[NASA-CR-158646] N79-24569
ELLIPSOMETERS
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108
EMISSION
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527
Emission density zoning guidebook. A technical guide to maintaining air quality standards through land-use-based emission limits
[PB-290657/6] N79-24579
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839
EMISSION SPECTRA
Measurement and comparison of relative free-atom fractions in the helium-oxygen-acetylene and air-acetylene flames
[AD-A066153] N79-24797
ENCAPSULATING
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
ENERGETIC PARTICLES
A rocket-borne electrostatic analyzer for measurement of energetic particle flux
[NASA-CR-158646] N79-24569
ELMO Bumpy Torus
[ORNL/TM-6743] N79-24842
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935
ENERGY ABSORPTION
Further developments in simple total energy sensors
N79-23900
ENERGY CONSERVATION
Modeling and verification of heat pump performance for industrial energy conservation
N79-24293
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489
Community application of integrated energy/utility systems
[PB-290675/8] N79-24520
Environmental development plan for transportation energy conservation. FY 1979 update
[ANL/EES-TM-33] N79-24899
ENERGY CONVERSION
Development of a modular software system for the dynamic simulation of coal conversion plants
[FE-2338-10] N79-24176
Clean solid and liquid fuels from coal
[FE-2047-8] N79-24185
Systems studies of coal conversion processes using a reference simulator
[FE-2275-8] N79-24187
Proceedings of the distribution automation and control working group. Volume 1: Executive summary
[NASA-CR-158642] N79-24259
Benefits of advanced technology in industrial cogeneration
[NASA-TM-79160] N79-24444
Thermoelectrochemical cycles for power and hydrogen production
[BNL-24387] N79-24491
Basic research on ceramic materials for energy storage and conversion system
[COO-2564-4] N79-24506
Hydrocarbons and energy from plants
[LBL-8596] N79-24507
Emergence of biotechnology
[TID-28983] N79-24626
ENERGY CONVERSION EFFICIENCY
In situ coal gasification modeling
[UCRL-82269] N79-24479
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877
ENERGY DISTRIBUTION
Secondary emission effects on spacecraft charging: Energy distribution considerations
N79-24047
ENERGY LEVELS
Localized sources of gamma rays of 3 to 25 MeV
N79-24933
ENERGY POLICY
Primary reflector for solar energy collection systems and method of making same
[NASA-CASE-NPO-13579-3] N79-24432
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Benefits of advanced technology in industrial cogeneration
[NASA-TM-79160] N79-24444
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445
Energy/Environment 3: Proceedings of the 3rd National Conference on the Interagency R and D Program
[PB-290558/6] N79-24535
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
ENERGY SOURCES
Low Btu coal gasification processes. Volume 1: Summary, screening, and comparisons
[ORNL/ENG/TM-13-VOL-1] N79-24188
ENERGY STORAGE
Cost-effective potential of optimumly designed heat pumps for the collection, storage, and distribution of solar energy
[BNL-25195] N79-24307
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Thermal Storage Applications Workshop. Volume 1: Plenary Session Analysis
[NASA-CR-158643] N79-24460
Preliminary long-term stability criteria for compressed air energy storage caverns in salt domes
[PNL-2871] N79-24487
Evaluation of a flywheel-powered shuttle car
[FE-8890] N79-24488
Hydrogen halogen energy storage system
[BNL-25212] N79-24492
Basic research on ceramic materials for energy storage and conversion system
[COO-2564-4] N79-24506
Design of optimum compressed air energy storage systems
[CONF-7811101-1] N79-24508
Method for the comparative economic assessment of energy storage systems
[BNL-25291] N79-24509
Energy storage with ambient temperature rechargeable lithium batteries
[PB-290934/9] N79-24518
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
ENERGY TECHNOLOGY
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
Solar technology in the Federal Republic of Germany
[NASA-TM-75634] N79-24439
Benefits of advanced technology in industrial cogeneration
[NASA-TM-79160] N79-24444
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459
Thermal Storage Applications Workshop. Volume 1: Plenary Session Analysis
[NASA-CR-158643] N79-24460
Thermal Storage Applications Workshop. Volume 2: Contributed Papers
[NASA-CR-158644] N79-24461
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers --- solving the heat transfer problem
[NASA-CR-158640] N79-24466
Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481
Solar project description: Aratex Services, Incorporated, industrial laundry, Fresno, California
[SOLAR/2008-78/50] N79-24485
Energy Materials Coordinating Committee (EMACC)
[DOE/US-002] N79-24490

Energy/Environment 3: Proceedings of the 3rd National Conference on the Interagency R and D Program
[PB-290558/6] N79-24535
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives — economic analysis
N79-24813
Translations on USSR science and technology: Physical sciences and technology, no. 67
[JPRS-73388] N79-24946
Power industry application of MHD technology
N79-24949

ENERGY TRANSFER
High energy resonance transfer laser study
[AD-A065926] N79-24333
Multistep energy migration and radiationless relaxation processes in phosphor and laser crystals
[AD-A066086] N79-24334

ENGINE CONTROL
The acceleration and braking capability of hydrostatic transmissions
[BLL-RTS-11821] N79-24348

ENGINE FAILURE
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968

ENGINE INLETS
Aerodynamic problems in engine airframe integration on fighter airplanes
[MBB-UFE-1359-O] N79-23936

ENGINEERING MANAGEMENT
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489

ENTRAINMENT
Vapour flows and heat conductances in ventilated cavities behind a two-dimensional cylinder. Part 1: Review of entrainment and thermodynamic effect; viscous effects on limited and developed cavitation
[OUEL-1245/78] N79-24314

ENTROPY
The theory of spectrum analysis of stochastic processes
[REPT-0-78] N79-24109
Calculation of the Kolmogorov entropy for motion along a stochastic magnetic field
[PPPL-1523] N79-24765

ENVIRONMENT EFFECTS
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 1: Executive summary
[NASA-TM-80354] N79-24435
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 2: Detailed assessment
[NASA-TM-80355] N79-24436
General-equilibrium approach to energy/environmental economic analysis
[BNL-24781] N79-24504
Energy/Environment 3: Proceedings of the 3rd National Conference on the Interagency R and D Program
[PB-290558/6] N79-24535
Spatial characteristics of net radiation and its components for Ontario
N79-24562
Partially balanced residual effects designs
N79-24709
Environmental development plan for transportation energy conservation. FY 1979 update
[ANL/EES-TM-33] N79-24899

ENVIRONMENT MODELS
Spacecraft charging modeling development and validation study
N79-24051

ENVIRONMENT PROTECTION
Protection, cleanup and restoration of salt marshes endangered by oil spills: A procedural manual
[PB-291958/7] N79-24522
A radiological environs study at a fuel fabrication facility
[PB-291928/0] N79-24530
Office of Research and Development program guide, fiscal year 1979
[PB-292003/1] N79-24912

ENVIRONMENT SIMULATION
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
A combined spacecraft charging and pulsed X-ray simulation facility
N79-24054
Further development of the multipactor discharge electron source
N79-24057

ENVIRONMENTAL CONTROL
Energy Materials Coordinating Committee [EMACC]
[DOE/US-002] N79-24490

ENVIRONMENTAL MONITORING
Methodologies of examining pollution from urban runoff
[PB-290595/8] N79-24427

ENVIRONMENTAL SURVEYS
Report to the Congress on ocean dumping research
[PB-292791/1] N79-24913

ENVIRONMENTAL TESTS
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471

ENVIRONMENTS
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory — for the demographic mapping program
[LBL-8707] N79-24894

EPITAXY
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108
Characterization and growth of epitaxial layers of GaAs exhibiting high resistivity for ionic implantation
[LEP-78/19.SME-441-H] N79-24881

EPOXY RESINS
Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071

EQUATIONS OF MOTION
An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982
On isochronous derivatives of the first and second order in space dynamics tasks
[NASA-TM-75617] N79-24694
A theory of anharmonic effects in vibrational nuclei — nonlinear equations of motion method
N79-24809

EQUATIONS OF STATE
Thermomechanical calculations for massive structures using a finite element method
[ISD-234] N79-24387

EQUATORIAL ATMOSPHERE
Comparative equatorial scintillation morphology: American and pacific sectors
[AD-A066094] N79-24224
Anomaly of the composition of the F-2 equatorial region of the ionosphere during the hours after sunset according to data from the mass-spectrometer experiment on the Cosmos-274
[NASA-TM-75615] N79-24565

EQUATORIAL ELECTROJET
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577

EQUILIBRIUM FLOW
Parameter dependence of equilibrium charging potentials
N79-24045

EQUIPMENT SPECIFICATIONS
Spacecraft charging standard
N79-24050
Digest of equipment for converting solar, wind, and geothermal energy into electric power for USN application ashore
[AD-A066221] N79-24475

EQUIVALENCE
Subsurface temperatures from surface heat flow data using equivalent plane sources
N79-24561

ERGODIC PROCESS
Convergence of non-ergodic dynamic systems — non-interfacing particles
[CTH-MATH-1977-18] N79-24720

ERROR ANALYSIS
Atmospheric refraction measurements and related efforts
[AD-A065766] N79-24574
Error analysis of digital filters with logarithmic number system
N79-24660

ERROR CORRECTING CODES
Feedback communications using coding in the forward link
N79-24209

ERROR DETECTION CODES
Development of Precision Optical Path Alignment System [POPAS]
[AD-A065673] N79-24823

ERROR FUNCTIONS
A method for waveform inversion of body-wave seismograms
N79-24558

ERYTHROCYTES
Validation of a model for investigating red cell mass changes during weightlessness
[NASA-CR-160188] N79-24634

ESA SATELLITES
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036

ESTUARIES
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418

ETHANE
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087

ETHERS
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164

ETHYLENE
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908

EUCLIDEAN GEOMETRY
Representing simple polytopes by order structures
N79-24688

EUROPE
Solar energy commercialization for European countries, volume 2
[HCP/CS-4250-VOL-2] N79-24493
Reports from the German Meteorological Service. Volume 18, No. 144. Contributions to the phenology of Europe. Part 3: Results from international phenological gardens [regional and annual differences] 1966-1975
[ISBN-3-88148-157-5] N79-24606

EUROPEAN SPACE PROGRAMS
Space research in Denmark
N79-24937

EUROPIUM COMPOUNDS
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855

EVALUATION
Development and implementation of productivity measurement systems with emphasis on interorganization relationships
N79-24195

EVOLUTION [DEVELOPMENT]
Types of karst, with emphasis on cover beds in their classification and development
N79-24556

EXCIMER LASERS
Excimer potential curves
[AD-A066043] N79-24332

EXCIMERS
Excimer potential curves
[AD-A066043] N79-24332

EXCITATION
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions
N79-24782
Differential cross section measurements for electron impact on barium in ground and laser excited states
N79-24785
Optimization and application of microwave-excited discharges
N79-24830

EXHAUST GASES
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system — for gas turbine engines
[NASA-TM-79154] N79-23965
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions
[PB-290612/1] N79-24191
Two-stage supercharger sets: Efficiency and head distribution under full- and part-load conditions
[RTS-11613] N79-24342
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770

EXPANDABLE STRUCTURES
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966

EXPERIMENTAL DESIGN
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055

EXPONENTIAL FUNCTIONS
Adaptive observers and controllers with an arbitrarily fast exponential rate of convergence
N79-24722

EXTREMELY LOW RADIO FREQUENCIES
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240

EXTREMUM VALUES
An analytical approach to wind velocity gust factors
[OUEL-1241/78] N79-24620

EXTRUDING
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298

F

F REGION
A review of recent results on spread F theory
[AD-A066175] N79-24233
Convective electric field measurements in an auroral plasma
N79-24552
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577
F 2 REGION
Anomaly of the composition of the F-2 equatorial region of the ionosphere during the hours after sunset according to data from the mass-spectrometer experiment on the Cosmos-274
[NASA-TM-75615] N79-24565
F-15 AIRCRAFT
Precision controllability of the F-15 airplane
[NASA-TM-72861] N79-23979
F-16 AIRCRAFT
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
FABRICATION
Composite materials with superplastic matrix
[BLL-RTS-11722] N79-24064
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459
Cuprous oxide photovoltaic cells --- fabricating schottky barrier devices
[PB-290529/7] N79-24514
Design, fabrication, and delivery of a charge injection device as a stellar tracking device
[NASA-CR-161226] N79-24919
FABRY-PEROT INTERFEROMETERS
Nonlinear optical processing with Fabry-Perot interferometers
N79-24817
FACTOR ANALYSIS
On the natural factor in nonlinear analysis
[ISD-242] N79-24702
FACTORIALS
Multi-Regge factorization in inclusive two-particle production
[ILL-(TH)-79-14] N79-24793
FAIL-SAFE SYSTEMS
Fail-safe optimal design of structures with substructuring
[AD-A065936] N79-23950
Module failure isolation circuit for paralleled inverters --- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254
FANS
Performance of two-stage fan with larger dampers on first-stage rotor
[NASA-TP-1399] N79-23967
FARM CROPS
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
FAST FOURIER TRANSFORMATIONS
Signal processing with saw devices
[AD-A065520] N79-24223
FAST NEUTRONS
Atmospheric neutrons
[NASA-CR-3126] N79-24631
FATIGUE (BIOLOGY)
Stress and fatigue in the driving environment --- physiological and psychological effects of heat and noise experienced inside automobiles
N79-24629
FATIGUE (MATERIALS)
An evaluation of stiffness reduction as a damage parameter and criterion for fatigue failure in composite materials
N79-24063
Investigation and characterization of constraint effects on flaw growth during fatigue loading of composite materials
[NASA-CR-158659] N79-24067
The fatigue of Ti6Al4V alloy in coarse and fine structural conditions under fully reverse loading as well as pulsating tension
N79-24119
Relation of structure to fatigue properties in aluminum-base alloys
[AD-A062698] N79-24127
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163
Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371
Bolted joint fatigue programme. Volume 1. Stage 1, sections 1 to 6
[AD-A064080] N79-24380
FATIGUE LIFE
Effect of high load on the fatigue behavior of unnotched graphite/epoxy laminates
[AD-A065631] N79-24069
FATIGUE TESTS
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 1
[LBF-TB-111-VOL-1] N79-24400
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 2
[LFB-TB-112-VOL-2] N79-24401
FEASIBILITY ANALYSIS
Feasibility study of the application of self-tuning controllers to chemical batch reactors --- temperature control
[OUEL-1248/78] N79-24326
A feasibility study of the use of radiant energy for fog dispersal
[AD-A063143] N79-24613
FEEDBACK
Feedback communications using coding in the forward link
N79-24209
Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627
FEEDBACK CONTROL
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
FERMIONS
Field theories with multiple Fermionic excitations
N79-24806
FERRIMAGNETISM
Local site distortion model of magnetostriction
[AD-A066250] N79-24763
FERRITES
Feasibility study of ferrite use at mm waves
[AD-A066178] N79-24235
FERROMAGNETIC MATERIALS
The magnetic induction of the system consisting of a coil and a ferromagnetic spherical body
[AD-A065809] N79-24266
FEVER
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
FIBER COMPOSITES
Fibrous refractory composite insulation --- shielding reusable spacecraft
[NASA-CASE-ARC-11169-1] N79-24062
FIBER OPTICS
The III - V heterostructure avalanche photodiode modules for fiber optic communication links in the 1.0 to 1.3 micrometer spectral range
[AD-A065537] N79-24272
Diversion and modulation of optical energy in graded index multimode fiber optics
[REPT-77-213/R] N79-24822
Array scanning for image transmission
[AD-A065583] N79-24825
FIELD EFFECT TRANSISTORS
Characterization and growth of epitaxial layers of GaAs exhibiting high resistivity for ionic implantation
[LEP-78/19.SME-441-H] N79-24881
FIELD STRENGTH
Investigation of methods for converting the FCC ground wave field intensity curves to the metric system
[PB-290930/7] N79-24250
FIELD THEORY (PHYSICS)
Field theories with multiple Fermionic excitations
N79-24806
High-temperature series expansion for the singlet-triplet model
N79-24864
Low temperature properties of bismuth films in large electric and magnetic fields
N79-24867
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations
N79-24886
FIGHTER AIRCRAFT
Development of an airborne military system [MRCA system]
[MBB-UFE-1322-O] N79-23904
Aerodynamic problems in engine airframe integration on fighter airplanes
[MBB-UFE-1359-O] N79-23936
FILM COOLING
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966
FINITE ELEMENT METHOD
A finite element method for the computation of the transonic potential flow past airfoils
[MBB-UFE-1352-O] N79-23935
Airfoil optimization for transonic flow using the methods of finite elements and characteristics
[MBB-UFE-1362-O] N79-23937
Comparison of NASCAP predictions with experimental data
N79-24013
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308
Numerical model development for laser cavity flowfields --- subroutine package for a variety of gas dynamics problems
[AD-A065836] N79-24336
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
Finite element analysis of arbitrary shells
N79-24368
Dynamic structural analysis with substructures
[AD-A065937] N79-24378
ANALYZE: Analysis of aerospace structures with membrane elements
[AD-A065633] N79-24379
Recent finite element studies in plasticity and fracture mechanics
[COO-3084-62] N79-24383
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386
Thermomechanical calculations for massive structures using a finite element method
[ISD-234] N79-24387
Geometrically nonlinear finite element behavior using buckling mode superposition
[ISD-241] N79-24391
Note on large strain applications of a modified constant strain finite element method
[ISD-248] N79-24393
Finite element grid optimization with interactive computer graphics
N79-24692
A convergence proof for constrained finite element solutions
[OUEL-1223/77] N79-24707
FIRE CONTROL
Documentation of software in the OL-192 meteorological data reduction program
[AD-A066218] N79-24614
FLAME RETARDANTS
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104
FLAME SPECTROSCOPY
A theoretical study into the spatial distribution of atoms surrounding an individual solute particle vaporizing in an analytical flame
[AD-A066182] N79-24796
Measurement and comparison of relative free-atom fractions in the helium-oxygen-acetylene and air-acetylene flames
[AD-A066153] N79-24797
FLARE STARS
A magnetic study of the spotted UV Ceti flare stars and related late-type dwarfs
N79-24918
FLAT PLATES
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376
FLAT SURFACES
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023
FLEXIBILITY
Flexural behavior of reinforced sulfur-infiltrated concrete beams
N79-24196
FLEXIBLE BODIES
Development of a prototype flexible radiator system
[NASA-CR-160166] N79-24299

FLIGHT CONTROL
Technical evaluation report on the 27th Guidance and Control Panel Symposium on the V/STOL Aircraft at Night and in Poor Visibility
[AGARD-AR-142] N79-23946
FLIGHT HAZARDS
Safety hazard of aircraft icing
N79-23916
FLIGHT INSTRUMENTS
The application of microprocessor technology to in-flight computation
N79-23902
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
FLIGHT PATHS
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769
FLIGHT SIMULATION
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968
A simplified rotor system mathematical model for piloted flight dynamics simulation
[NASA-TM-78575] N79-23977
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770
FLIGHT SIMULATORS
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
FLIGHT TESTS
Plasma Interaction Experiment [PIX] flight results
N79-24022
Flame nosetip recovery vehicle flight test series
[AD-A066217] N79-24058
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395
FLOOD CONTROL
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904
FLOOD PLAINS
Urban water resources policy alternatives: A sociological analysis of differential perspectives
[PB-290583/4] N79-24538
FLOODS
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data
[NASA-TM-79689] N79-24421
FLOW CHARACTERISTICS
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969
Evaluation of flow properties of dilute aqueous polymer solutions for enhanced oil recovery applications
N79-24408
FLOW DISTORTION
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968
FLOW DISTRIBUTION
A marching method for calculating line and continuum radiation in high energy flow fields
[NASA-CR-3046] N79-24302
The structure of turbulent velocity fields
[AD-A065666] N79-24304
Identification of flow type using heated thin films
[OUEL-1238/78] N79-24313
Numerical model development for laser cavity flowfields --- subroutine package for a variety of gas dynamics problems
[AD-A065836] N79-24336
FLOW EQUATIONS
The flow through a gauze screen
[ATN-7801] N79-24301
FLOW VELOCITY
The structure of turbulent velocity fields
[AD-A065666] N79-24304
FLOW VISUALIZATION
Some experimental observations of the flow through gauze screens
[ATN-7804] N79-24300
FLOWMETERS
Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321
FLUCTUATION THEORY
Fluctuations in active molecular plasmas
[CTH-IEFT/PP-1978-1] N79-24849
FLUID BOUNDARIES
Heat transfer simulation in underground coal liquefaction
N79-24292
FLUID DYNAMICS
Aerodynamics
[NASA-TT-F-765] N79-23908
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas
N79-24730
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations
N79-24886
FLUID FILMS
The effects of finite size on the critical behavior of fluid films
N79-24288
FLUID FILTERS
Fluid sample collection and distribution system --- qualitative analysis of aqueous samples from several points
[NASA-CASE-MSC-16841-1] N79-24285
FLUID FLOW
Some experimental observations of the flow through gauze screens
[ATN-7804] N79-24300
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319
FLUID MECHANICS
Aerodynamics
[NASA-TT-F-765] N79-23908
Activities of the International Meteorological Institute
[AR-77-78] N79-24590
FLUIDIZED BED PROCESSORS
Improved techniques for gasifying coal
[FE-2340-7] N79-24186
FLUORESCENCE
Research in gas lasers
[AD-A065743] N79-24331
FLUORINE COMPOUNDS
Research in fluorine chemistry
[AD-A065527] N79-24099
FLUOROPOLYMERS
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures
[NASA-CASE-ARC-11241-1] N79-24153
Ion beam sputter deposition of fluoropolymers
[NASA-CASE-LEW-13122-1] N79-24154
FLUX [RATE]
A rocket-borne electrostatic analyzer for measurement of energetic particle flux
[NASA-CR-158646] N79-24569
FLYWHEELS
Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071
Evaluation of a flywheel-powered shuttle car
[FE-8890] N79-24488
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
FOG
The holographic recording of a moving water aerosol
[BLL-TRANS-1370-[9022.549]]
N79-24322
FOG DISPERSAL
A feasibility study of the use of radiant energy for fog dispersal
[AD-A063143] N79-24613
FORECASTING
A simple method for an objective, local forecast of gusts
[BLL-TRANS-1393-[9022.549]]
N79-24604
FORESTS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
FORGING
Effects of hot forging variables upon microstructure and properties of metals and alloys
[AD-A065674] N79-24123
Effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al
[AD-A066062] N79-24124
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128
FORMALDEHYDE
Rapid method for determining free formaldehyde in phenol-formaldehyde resins
[BLL-RTS-11594] N79-24144
FORMING TECHNIQUES
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
FORTRAN
SABAB: A program for calculating satellite ephemerides
[REPT-10-78] N79-23993
FOURIER TRANSFORMATION
Coded imaging systems using a Fourier aperture
N79-24818
FRACTIONATION
Analysis of a fractional gas stripper
N79-24084
FRACTOGRAPHY
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
FRACTURE MECHANICS
Production of cracks in ZnS under a uniform dynamic stress field
[AD-A065941] N79-24159
Numerical investigations of fracture and micromechanics in ceramics
[AD-A066252] N79-24166
Recent finite element studies in plasticity and fracture mechanics
[COO-3084-62] N79-24383
Stress crack phenomena volume 3. A bibliography with abstracts
[NTIS/PS-79/0269/5] N79-24403
Stress crack phenomena volume 4. A bibliography with abstracts
[NTIS/PS-79/0270/3] N79-24404
FRACTURING
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
FREE ELECTRONS
Diffusion limit for the transport of quasifree electrons in liquids
[AD-A065679] N79-24795
FREE ENERGY
On the correlation of the kinetics of electron transfer processes with the change in reaction free energy. Application to electron-exchange initiated chemiluminescence reactions
[AD-A066342] N79-24105
FREE FLIGHT
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
FREEZING
Design and evaluation of aircraft heat source systems for use with high-freezing point fuels
[NASA-CR-159568] N79-24172
FRENKEL DEFECTS
Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857
FREQUENCIES
Optimum frequencies for aircraft classification
[AD-A065697] N79-24220
Probe measurement technique in a Tokamak
[BLL-CTO/1563-[9091.9F]] N79-24831
FREQUENCY ASSIGNMENT
Spectrum efficiency for multiple independent spread-spectrum land mobile radio systems
[PB-291539/5] N79-24248
An automated retrieval system for frequency allocation information
[PB-291600/5] N79-24251
FREQUENCY DISTRIBUTION
A modular multiple use system for precise time and frequency measurement and distribution
N79-24742
FREQUENCY MEASUREMENT
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731
A modular multiple use system for precise time and frequency measurement and distribution
N79-24742
Frequency domain measurement systems
N79-24744
FREQUENCY SHIFT
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
FREQUENCY STABILITY
Composite oscillator systems for meeting user needs for time and frequency
N79-24733
Acceleration sensitivity compensation in high performance crystal oscillators
N79-24735
Time domain measurement of frequency stability: A tutorial introduction
N79-24741

FREQUENCY STANDARDS
Proceedings of the Tenth Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting
[NASA-TM-80250] N79-24731
Composite oscillator systems for meeting user needs for time and frequency
N79-24733
Relationships between the performance of time/frequency standards and navigation/communication systems
N79-24734
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
Performance of preproduction model cesium beam frequency standards for spacecraft applications
N79-24740
Rubidium frequency standard test program for NAVSTAR GPS
N79-24745
Submicrosecond comparisons of time standards via the Navigation Technology Satellites [NTS]
N79-24756
FREQUENCY SYNCHRONIZATION
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731
FRICTION
Coefficients of friction between calcareous sands and some building materials, and their significance
[AD-A066297] N79-24198
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396
FRICTION REDUCTION
Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910
FROZEN FOODS
The design, construction and calibration of a research cold room complex
[CSIR-ME-1577] N79-23983
FUEL COMBUSTION
Experimental study of the kinetics of dry, forward combustion
[BETC-1820-1] N79-24106
Investigations into mixture preparation and combustion in the hydrogen engine
[BLL-RTS-11807] N79-24346
FUEL INJECTION
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343
The 1.11 new considerations on the development of vortex ports --- for small capacity direct injection engine
[BLL-RTS-11759] N79-24347
FUEL SYSTEMS
Method for determining the state of a fuel mixture at the inlet manifold of an M 207 motor under non-adiabatic conditions
[BLL-RTS-11509] N79-24341
FUEL TANKS
Inflight fuel tank temperature survey data
[NASA-CR-159569] N79-23940
Control of volatile organic emissions from petroleum liquid storage in external floating roof tanks
[PB-290579/2] N79-24537
FUEL-AIR RATIO
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system --- for gas turbine engines
[NASA-TM-79154] N79-23965
FUELS
Densified biomass: A new form of solid fuel
[SERI-35] N79-24180
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
FUNCTION SPACE
L sub p-intensities of random measures
[CTH-MATH-1978-2] N79-24704
FUNCTIONAL ANALYSIS
The operational approach to physical geodesy
[AD-A063887] N79-24422
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775
FUNCTIONAL INTEGRATION
L sub p-intensities of random measures
[CTH-MATH-1978-2] N79-24704
FURNACES
Laser-zone growth in a Ribbon-to-Ribbon (RTR) process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473
FUSELAGES
Fuselage-mounted antenna code: User's manual
[AD-A065587] N79-24215

G

GALACTIC RADIATION
Localized sources of gamma rays of 3 to 25 MeV
N79-24933
GALACTIC ROTATION
Collisionless galaxy simulations
[NASA-RP-1037] N79-24921
GALERKIN METHOD
A study of the Galerkin-Dorodnitsyn method applied to a three-dimensional, quasi-steady melting problem with a moving irradiation source
N79-24874
GALLIUM
Gallium-doped germanium, evaluation of photoconductors, part 1
[NASA-CR-152222] N79-24875
GALLIUM ARSENIDES
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108
High energy proton radiation damage to [AlGa]As-GaAs solar cells
[NASA-CR-3148] N79-24261
GaAs waveguide detector array for an IOC spectrum analyzer
[AD-A065824] N79-24265
High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
GaAs electroabsorption avalanche photodiode waveguide detectors
[AD-A065986] N79-24824
Characterization and growth of epitaxial layers of GaAs exhibiting high resistivity for ionic implantation
[LEP-78/19.SME-441-H] N79-24881
GAME THEORY
Life games: Statistical, deterministic and computer approaches in physics
N79-24721
GAMMA RAY ASTRONOMY
Localized sources of gamma rays of 3 to 25 MeV
N79-24933
GARNETS
Local site distortion model of magnetostriction
[AD-A066250] N79-24763
GAS ANALYSIS
Analysis of a fractional gas stripper
N79-24084
GAS COMPOSITION
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
GAS DYNAMICS
Aerodynamics
[NASA-TT-F-765] N79-23908
Numerical model development for laser cavity flowfields --- subroutine package for a variety of gas dynamics problems
[AD-A065836] N79-24336
GAS FLOW
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343
GAS IONIZATION
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934
GAS LASERS
Research in gas lasers
[AD-A065743] N79-24331
GAS MIXTURES
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system --- for gas turbine engines
[NASA-TM-79154] N79-23965
Method for determining the state of a fuel mixture at the inlet manifold of an M 207 motor under non-adiabatic conditions
[BLL-RTS-11509] N79-24341
Measurement and comparison of relative free-atom fractions in the helium-oxygen-acetylene and air-acetylene flames
[AD-A066153] N79-24797
GAS TURBINE ENGINES
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system --- for gas turbine engines
[NASA-TM-79154] N79-23965
GAS TURBINES
Turbine design system
[AD-A066092] N79-23974
Engine rotor dynamics, synchronous and nonsynchronous whirl control
[AD-A066093] N79-23975
Feasibility and economics of cogeneration in California's thermal enhanced oil recovery operations
[PB-291794/6] N79-24517
GAS VALVES
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497
GAS-LIQUID INTERACTIONS
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
GAS-SOLID INTERFACES
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108
GASEOUS DIFFUSION
A proton activation study of oxygen diffusion in multicomponent glass-forming systems
N79-24152
GASES
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
GASOHOL (FUEL)
Gasohol test program
[PB-290569/3] N79-24193
GASOLINE
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104
Stability characteristics of hydrocarbon fuels from alternative sources
[BETC/RI-78/23] N79-24178
Motor gasolines, summer 1978
[BETC/PPS-79/1] N79-24189
Fluid bed process studies on selective conversion of methanol to high octane gasoline
[FE-2490-15] N79-24190
Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions
[PB-290612/1] N79-24191
Automotive Fuel Economy Contractor's Coordination Meeting
[PB-290516/4] N79-24358
GENERAL AVIATION AIRCRAFT
A review of the icing situation from the standpoint of general aviation
N79-23918
GEODESY
The operational approach to physical geodesy
[AD-A063887] N79-24422
GEOGRAPHY
Geographical information systems: A review
[PB-290748/3] N79-24424
GEOLOGICAL FAULTS
Generalized ray models of strong ground motion
N79-24557
Recent vertical crustal movements from leveling observations in the Rio Grande rift: A review
[LA-UR-78-3195] N79-24589
GEOLOGICAL SURVEYS
Results of the geoscientific investigations from the VALDIVA cruise VA-10/1975 off Western Africa
[BMFT-FB-M-78-03] N79-24592
High speed TV-towing system for project definition study for conception and design of a deep sea towing system with two instrumented exploration instrumental bodies in a tandem configuration for close to sea floor control
[BMFT-FB-M-77-05] N79-24623
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816
GEOLOGY
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Physical properties of sediments from the continental margin of western Africa
N79-24555
GEOMAGNETIC PULSATIONS
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240
GEOMAGNETISM
Spacecraft charging results for the DSCS-3 satellite
N79-24014
GEOMETRY
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control
N79-23895
GEOSYNCHRONOUS ORBITS
Modeling of the geosynchronous plasma environment
N79-24003
Average plasma environment at geosynchronous orbit
N79-24004

Geosynchronous satellite operating anomalies caused by interaction with the local spacecraft environment
N79-24049
GEOTHERMAL ENERGY CONVERSION
Digest of equipment for converting solar, wind, and geothermal energy into electric power for USN application ashore
[AD-A066221] N79-24475
GEOTHERMAL RESOURCES
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
Self-starting manual for direct use applications of geothermal resources
[PB-290872/1] N79-24423
GERMANIUM
Gallium-doped germanium, evaluation of photoconductors, part 1
[NASA-CR-152222] N79-24875
GERMANY
Solar technology in the Federal Republic of Germany
[NASA-TM-75634] N79-24439
GLASS
Spectroscopic investigations of metal cation reduction at glass surfaces
N79-24079
Heliostat glass survey and analysis
[PNL-2868] N79-24170
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452
GLASS ELECTRODES
Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646
GLIDERS
An exploratory investigation of the effect of plastic coating on the profile drag of a practical-metal-construction sailplane airfoil
N79-23891
Optimum tail plane design for sailplanes
N79-23892
The application of microprocessor technology to in-flight computation
N79-23902
Design of propellers for motorsoarers
N79-23903
GLIDING
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
GLOBAL POSITIONING SYSTEM
The NAVSTAR global positioning system: A program with many uncertainties
[PB-291438/0] N79-23944
Rubidium frequency standard test program for NAVSTAR GPS
N79-24745
Clock performance as a critical parameter in navigation satellite systems
N79-24750
GOVERNMENT PROCUREMENT
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489
GOVERNMENT/INDUSTRY RELATIONS
Developing a domestic common carrier telecommunications policy: What are the issues
[PB-290787/1] N79-24249
GOVERNMENTS
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907
GRAIN BOUNDARIES
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764
GRANULAR MATERIALS
Thermal conductivity of granular aluminum
N79-24852
GRAPH THEORY
Interval counts and threshold numbers of graphs
N79-24689
GRAPHITE
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061
GRAPHITE-EPOXY COMPOSITE MATERIALS
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066
Effect of high load on the fatigue behavior of unnotched graphite/epoxy laminates
[AD-A065631] N79-24069
The potential for accidental release of carbon/graphite fibers from resin matrix composites as determined by thermogravimetric analysis
[AD-A065962] N79-24070
GRASSLANDS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
GRATINGS [SPECTRA]
Coded imaging systems using a Fourier aperture
N79-24818
A study of grating filters in thin-film optical waveguides
N79-24819
GRAVITATION
Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916
GRAVITATIONAL FIELDS
The operational approach to physical geodesy
[AD-A063887] N79-24422
Neutrinos and long-range weak forces in cosmology
N79-24882
GRAVITY WAVES
Gravity waves and diffusion in a liquid covered by a superficial film
[REPT-77-3] N79-24310
GREASES
Grease life estimation in rolling bearings
[ESDU-78032] N79-24344
GREAT PLAINS CORRIDOR [NORTH AMERICA]
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
GREEN FUNCTION
Generalized ray models of strong ground motion
N79-24557
GROOVING
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
GROUND STATE
Differential cross section measurements for electron impact on barium in ground and laser excited states
N79-24785
GROUND TESTS
Spacecraft charging modeling development and validation study
N79-24051
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295
GROUND WATER
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426
GROUND WAVE PROPAGATION
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247
Investigation of methods for converting the FCC ground wave field intensity curves to the metric system
[PB-290930/7] N79-24250
GROUP THEORY
On rational approximations of semigroups
[CTH-MATH-1978-3] N79-24729
GROWTH
Role of inorganic carbon availability in the formation of nuisance blooms of blue-green algae
[PB-290716/0] N79-24542
GUNS [ORDNANCE]
Precision controllability of the F-15 airplane
[NASA-TM-72861] N79-23979
GUST LOADS
An analytical approach to wind velocity gust factors
[OUEL-1241/78] N79-24620
GUSTS
A simple method for an objective, local forecast of gusts
[BLL-TRANS-1393-(9022.549)]
N79-24604

H

HALIDES
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277
HALOGEN COMPOUNDS
Inorganic halogen oxidizer research
[AD-A066149] N79-24177
HALOGENS
Hydrogen halogen energy storage system
[BNL-25212] N79-24492
HAMILTONIAN FUNCTIONS
Lie transforms and their use in Hamiltonian perturbation theory
[DOE/ET-0074] N79-24727
HAND [ANATOMY]
Compact artificial hand
[NASA-CASE-NPO-13906-1] N79-24652
HANDBOOKS
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527
HANKEL FUNCTIONS
The Hankel autocorrelation --- and Hankel spectrum
N79-24690
HARDNESS
Effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al
[AD-A066062] N79-24124
HARDWARE
Real-time video filtering with bit-slice microprogrammable processors
N79-24207
HARMONIC ANALYSIS
The Hankel autocorrelation --- and Hankel spectrum
N79-24690
HAWAII
Stream channel modification in Hawaii, part A: Statewide inventory of streams, habitat factors and associated biota
[PB-290571/9] N79-24425
Investigations of sediment cores from the central Pacific SE of Hawaii from the VALDIVIA cruise 13/1
[BMFT-FB-M-77-08] N79-24624
HAZARDS
Earthquake hazards reduction: Issues for an implementation plan
[PB-290467/0] N79-24593
Evaluation and prediction of avalanche hazard, San Juan Mountains, Colorado
[PB-290854/9] N79-24594
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907
HEAD [ANATOMY]
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627
HEAD-UP DISPLAYS
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
HEALTH PHYSICS
An analysis of air pollution and its health effects: Washington, D. C. metropolitan area
[PB-290618/8] N79-24545
Atmospheric neutrons
[NASA-CR-3126] N79-24631
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642
HEAT
Large Area Crop Inventory Experiment [LACIE]. Development of procedure M for multicrop inventory, with tests of a spring-wheat configuration
[E79-10197] N79-24416
HEAT BALANCE
Preliminary investigation of the nonsteady combustion and flow processes of the Naval Academy Heat Balanced Engine [NAHBE]
[AD-A066085] N79-24101
HEAT CAPACITY MAPPING MISSION
HCMM: Soil moisture in relation to geologic structure and lithology, northern California
[E79-10192] N79-24412
HEAT PIPES
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
HEAT PUMPS
Modeling and verification of heat pump performance for industrial energy conservation
N79-24293
Cost-effective potential of optimumly designed heat pumps for the collection, storage, and distribution of solar energy
[BNL-25195] N79-24307
Heat pumps. Citations from the NTIS data base --- a bibliography with abstracts
[NTIS/PS-79/0232/3] N79-24316
Heat pumps, volume 1. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0233/1] N79-24317
Heat pumps, volume 2. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0234/9] N79-24318
HEAT RESISTANT ALLOYS
Superalloys, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0220/8] N79-24139

Superalloys, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0221/6] N79-24140
HEAT SHIELDING
Thermal blanket metallic film groundstrap and second surface mirror vulnerability to arc discharges
N79-24042
HEAT SOURCES
Design and evaluation of aircraft heat source systems for use with high-freezing point fuels
[NASA-CR-159568] N79-24172
Heat source component development program
[BMI-X-699] N79-24799
HEAT STORAGE
Thermal Storage Applications Workshop. Volume 2: Contributed Papers
[NASA-CR-158644] N79-24461
HEAT TOLERANCE
Stress and fatigue in the driving environment --- physiological and psychological effects of heat and noise experienced inside automobiles
N79-24629
HEAT TRANSFER
Hypersonic heat transfer test program in the VKI Longshot Facility
[AD-A065645] N79-23926
Heat transfer simulation in underground coal liquefaction
N79-24292
An experimental investigation of the natural convection boundary layer over a uniform flux inclined surface
N79-24294
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers --- solving the heat transfer problem
[NASA-CR-158640] N79-24466
Chemical and optical studies of heat transfer fluids containing solar energy absorbers
[MLM-2549[OP]] N79-24505
Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607
On the mathematical formulation of the first principle of thermodynamics for non-uniform temperature processes
[OUEL-1251/78] N79-24887
HEAT TRANSMISSION
Subsurface temperatures from surface heat flow data using equivalent plane sources
N79-24561
HEATING EQUIPMENT
Prototype solar heating and cooling systems
[NASA-CR-161204] N79-24437
HELICOPTER CONTROL
Evaluation of a digital helicopter control system --- BO-105 helicopter
[MBB-UFE-1349-O] N79-23980
HELICOPTER DESIGN
Interactional aerodynamics of the single rotor helicopter configuration. Volume 2B: Harmonic analyses of airframe surface pressure data, runs 7 - 14, midsection
[AD-A061860] N79-23934
Fail-safe optimal design of structures with substructuring
[AD-A065936] N79-23950
HELICOPTER ENGINES
Driveshaft alignment indicator
[AD-A065988] N79-23973
HELICOPTER WAKES
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3A: Flow angle and velocity wake profiles in low frequency band, basic investigations and hub variations
[AD-A061766] N79-23932
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3B: Flow angle and velocity wake profiles in low frequency band, air ejector systems and other devices
[AD-A061767] N79-23933
HELICOPTERS
Civil Helicopter icing problems
N79-23917
Overview of helicopter ice protection system developments
N79-23919
Technical evaluation report on the 27th Guidance and Control Panel Symposium on the V/STOL Aircraft at Night and in Poor Visibility
[AGARD-AR-142] N79-23946
HELIOSTATS
Heliostat glass survey and analysis
[PNL-2868] N79-24170
Heliostat for astronomical usage
[NASA-TM-75481] N79-24920
HELIUM
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames
[AD-A066083] N79-24100
HELIUM ATOMS
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions
N79-24782
HELIUM IONS
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784
Hydrogen depth profiling using elastic recoil detection --- using helium ions
[SAND-79-0210C] N79-24878
HELIUM ISOTOPES
The viscosity of normal and superfluid helium three
N79-24861
Superfluid 3He in narrow cylinders --- nuclear magnetic resonance
N79-24873
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935
HELIUM PLASMA
Acoustic emission spectral calibration and analysis --- using a helium jet
[ARL-MAT-NOTE-125] N79-24772
HELMETS
Impact tests on crash helmets for motor cyclists
[AD-A065966] N79-24655
HIGH ALTITUDE
Numerical calculations of high-altitude differential charging: Preliminary results
N79-24016
Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions
[PB-290612/1] N79-24191
Flight test evaluation of an RAF high altitude partial pressure protective assembly
[NASA-TM-72864] N79-24654
HIGH ENERGY INTERACTIONS
The measurement of absolute pair production cross-sections at near-threshold energies and the development of a high resolution position spectrometer
N79-24783
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807
Interactions of relativistic charged particle beams
[AD-A066045] N79-24814
Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832
HIGH POWER LASERS
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781
HIGH PRESSURE
Performance of two-stage fan with larger dampers on first-stage rotor
[NASA-TP-1399] N79-23967
Test and evaluation of MAKO high-pressure breathing air compressor KA-51-DF
[AD-A065553] N79-24353
Relaxation of excited neon atoms in their parent gas
N79-24786
HIGH RESOLUTION
High resolution electron microscopy of sulfides
N79-24863
HIGH TEMPERATURE
Investigation of medium and high temperature phase change materials
[NASA-TM-75398] N79-24097
Multi-fluid, high temperature cavitation tunnel: Description and operating manual
[OUEL-1196/77] N79-24311
HIGH TEMPERATURE AIR
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497
HIGH TEMPERATURE ENVIRONMENTS
Heat source component development program
[BMI-X-699] N79-24799
HIGH TEMPERATURE FLUIDS
High-temperature microphone system --- for measuring pressure fluctuations in gases at high temperature
[NASA-CASE-LAR-12375-1] N79-24203
HIGH TEMPERATURE RESEARCH
High-temperature series expansion for the singlet-triplet model
N79-24864
HIGH VOLTAGES
NASCAP modelling of high-voltage power system interactions with space charged-particle environments
[NASA-TM-79146] N79-24000
HILBERT SPACE
Catastrophe theory in Hilbert Space
[CTH-MATH-1977-17] N79-24703
HISTOGRAMS
Lunar laser ranging data deposited in the National Space Science Data Center normal points, filtered observations, and unfiltered photon detections
[NASA-CR-158648] N79-24931
HISTORIES
Executive summary of Aircraft Icing Specialists Workshop
N79-23914
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
HOLOGRAMMETRY
A cookbook for dichromated gelatin holograms
[AD-A065642] N79-24324
HOLOGRAPHY
Digital recording using hologram arrays: Laser-beam deflection and modulation
[BBC-RD-1979/6] N79-24320
The holographic recording of a moving water aerosol
[BLL-TRANS-1370-[9022.549]]
N79-24322
A cookbook for dichromated gelatin holograms
[AD-A065642] N79-24324
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
HOMEOSTASIS
Acid-base homeostasis in the human system
[NASA-CR-12932] N79-24640
HOMING DEVICES
Automatic target hand-off for non-compatible imaging systems
[AD-A065525] N79-24222
HONEYCOMB STRUCTURES
Evaluation of new bonding systems for depot-level maintenance of aircraft honeycomb panels
[AD-A066117] N79-24161
HORIZONTAL TAIL SURFACES
Optimum tail plane design for sailplanes
N79-23892
HORN ANTENNAS
Antennas and the associated time domain range for the measurement of impulsive fields
[PB-291733/4] N79-24253
HORSEPOWER
High impact shock evaluation of the diode assembly design used in a 3000-horsepower generator
[AD-A066143] N79-24276
HOT WORKING
Effects of hot forging variables upon microstructure and properties of metals and alloys
[AD-A065674] N79-24123
HOT-FILM ANEMOMETERS
Identification of flow type using heated thin films
[OUEL-1238/78] N79-24313
Hot-wire and hot-film anemometry
[NASA-TM-75413] N79-24323
HOT-WIRE ANEMOMETERS
Hot-wire and hot-film anemometry
[NASA-TM-75413] N79-24323
HUMAN BEHAVIOR
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657
HUMAN BEINGS
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
Acid-base homeostasis in the human system
[NASA-CR-12932] N79-24640
Chemicals identified in human biological media, a pilot literature survey
[PB-290690/7] N79-24649
HUMAN BODY
An analysis of air pollution and its health effects: Washington, D. C. metropolitan area
[PB-290618/8] N79-24545
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
HUMAN FACTORS ENGINEERING
The time budget as a criterion for the workload of air traffic controllers
[MBB-UFE-1353-O] N79-23943
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
Human factors engineering research for Cabin Taxi [CAT]
[MBB-UFE-1355-O] N79-24901

HUMAN PATHOLOGY
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
HUMAN PERFORMANCE
An investigation of a human information processing model for decision making
[AD-A065912] N79-24890
HUMAN REACTIONS
Stress and fatigue in the driving environment — physiological and psychological effects of heat and noise experienced inside automobiles
N79-24629
Significant characteristics of social response to noise and vibration
[NASA-TM-75412] N79-24888
HUMIDITY
Temporal and spatial distribution of humidity in a small city
N79-24599
HUNGARY
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
HURRICANES
Disturbed versus undisturbed conditions in the Caribbean during the intensification of Hurricane Carmen [1974]
[AD-A065317] N79-24612
HYBRID CIRCUITS
Manufacturing methods and technology engineering for tape chip carrier
[AD-A065890] N79-24270
HYDRAULIC CONTROL
An electric control for an electrohydraulic active control aircraft landing gear
[NASA-CR-3113] N79-23948
HYDRAULIC EQUIPMENT
The acceleration and braking capability of hydrostatic transmissions
[BLL-RTS-11821] N79-24348
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program — for the space shuttle orbiter
[NASA-CR-160178] N79-24672
HYDRAULIC FLUIDS
Water absorption of fluids/oils — contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158
HYDRAULIC TEST TUNNELS
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921
Multi-fluid, high temperature cavitation tunnel: Description and operating manual
[OUEL-1196/77] N79-24311
HYDRAZINES
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
HYDROCARBON FUELS
Stability characteristics of hydrocarbon fuels from alternative sources
[BETC/RI-78/23] N79-24178
HYDROCARBONS
Hydrocarbons and energy from plants
[LBL-8596] N79-24507
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521
HYDROCHLORIC ACID
On tha reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl
[MPIS-19/1977] N79-24805
HYDRODYNAMICS
Hydrodynamic lubrication with wear and asperity contact in mechanical face seals
[AD-A065924] N79-24357
HYDROGEN
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
Hydropyrolysis of coal derived liquids and related model compounds
N79-24171
Systems studies of coal conversion processes using a reference simulator
[FE-2275-8] N79-24187
Design, fabrication and test of a hydrogen heat pipe — extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
Hydrogen depth profiling using elastic recoil detection — using helium ions
[SAND-79-0210C] N79-24878
HYDROGEN CLOUDS
An investigation of the intergalactic medium via the 21 cm line of neutral hydrogen
N79-24922
HYDROGEN EMBRITTLEMENT
Morphology and mechanism of hydrogen attack in iron-carbon alloys
N79-24117
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
Hydrogen embrittlement of metals, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0177/0] N79-24135
Hydrogen embrittlement of metals, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/0178/8] N79-24136
Hydrogen embrittlement of metals, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0179/6] N79-24137
Hydrogen embrittlement of metals. Citations from the American Petroleum Institute data base
[NTIS/PS-79/0180/4] N79-24138
HYDROGEN ENGINES
Investigations into mixture preparation and combustion in the hydrogen engine
[BLL-RTS-11807] N79-24346
HYDROGEN ISOTOPES
Proposed implementation of laser Raman scattering spectroscopy for analysis of hydrogen isotopes
[MLM-2583] N79-24107
HYDROGEN-BASED ENERGY
Hydrogen halogen energy storage system
[BNL-25212] N79-24492
HYDROGEOLOGY
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426
HYDROLOGY
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data
[NASA-TM-79689] N79-24421
Self-starting manual for direct use applications of geothermal resources
[PB-290872/1] N79-24423
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
HYDROLOGY MODELS
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911
HYDROLYSIS
The high temperature aqueous modification of polybutadiene and a styrene crosslinked unsaturated polyester
N79-24145
HYDROMETEOROLOGY
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608
HYDROXYL COMPOUNDS
Biodegradable polymer: Synthesis and characterization of methyl- and hydroxyl-containing polyamides, polyfumaramides, and polyenamines
N79-24147
HYPERSONIC FLOW
Hypersonic heat transfer test program in the VKI Longshot Facility
[AD-A065645] N79-23926
Roll-damping derivative calculations for spinning sharp and blunt cones in supersonic and hypersonic flow
[AD-A065594] N79-23927
Measurement of the drag of slender cones in hypersonic flow at low Reynolds numbers using a magnetic suspension and balance
[OUEL-1235/78] N79-23938

I

ICE FORMATION
Aircraft icing
[NASA-CP-2086] N79-23912
Aircraft icing: Introduction
N79-23913
Executive summary of Aircraft Icing Specialists Workshop
N79-23914
Icing of aircraft Some remarks with an historical slant from a cloud physicist
N79-23915
Safety hazard of aircraft icing
N79-23916
Civil Helicopter icing problems
N79-23917
A review of the icing situation from the standpoint of general aviation
N79-23918
Overview of helicopter ice protection system developments
N79-23919
IGNITION
The combustion of organic polymeric materials. Ignition properties
[AD-A065967] N79-24162
ILLINOIS
Stratification and sample selection for multicrop experiments — Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
The economic impact analysis of effluent standards for total dissolved solids
[PB-290916/6] N79-24541
IMAGE PROCESSING
Computer image generation: Improved edge utilization study
[AD-A065640] N79-24673
Nonlinear optical processing with Fabry-Perot interferometers
N79-24817
Coded imaging systems using a Fourier aperture
N79-24818
Array scanning for image transmission
[AD-A065583] N79-24825
New techniques for tracking sequences of digitized images
[AD-A066194] N79-24828
IMAGERY
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
IMAGING TECHNIQUES
The holographic recording of a moving water aerosol
[BLL-TRANS-1370-[9022.549]]
N79-24322
An investigation of the pulse-scatter imaging technique for medical ultrasonic imaging and tissue characterization
N79-24628
Design, fabrication, and delivery of a charge injection device as a stellar tracking device
[NASA-CR-161226] N79-24919
IMPACT TESTS
Impact tests on crash helmets for motor cyclists
[AD-A065966] N79-24655
IMPULSES
An impulse control policy for a class of jump diffusion processes
[CSIR-T-WISK-55] N79-24698
IMPURITIES
Agitated batch and packed column activated carbon adsorption
N79-24090
Study of the effects of impurities on the properties of silicon materials and performance of silicon solar cell
[NASA-CR-158678] N79-24447
Analysis of the effects of impurities in silicon
[NASA-CR-157439] N79-24456
Effects of impurities and processing on silicon solar cells, phase 3
[NASA-CR-158569] N79-24472
Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835
IN-FLIGHT MONITORING
Inflight fuel tank temperature survey data
[NASA-CR-159569] N79-23940
INCINERATORS
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468
INCOHERENT SCATTERING
Study of the influence of negative ions on the incoherent scattering spectra — mesophere
[CEPHAG-45/77] N79-24242
INCOMPRESSIBLE FLOW
Numerical solution of the two-dimensional nonsteady mean Navier-Stokes equations for incompressible flows past arbitrary shaped bodies
N79-23905
The flow through a gauze screen
[ATN-7801] N79-24301
INDEPENDENT VARIABLES
A statistical rationale for relating situational attributes and individual differences
[AD-A066088] N79-24718
INDEXES [DOCUMENTATION]
Evaluation of computer aided indexing of information for support of contract appeals
[AD-A065835] N79-24893
INDIA
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory — Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective — United States of

America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
Clock synchronisation experiment in India using symphonie satellite
N79-24758

INDIANA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410

INDICATING INSTRUMENTS
Development of sensitized pick coal interface detector system
[NASA-CR-161225] N79-24417

INDIUM ANTIMONIDES
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839

INDUSTRIAL ENERGY
Modeling and verification of heat pump performance for industrial energy conservation
N79-24293
Benefits of advanced technology in industrial cogeneration
[NASA-TM-79160] N79-24444
General-equilibrium approach to energy/environmental economic analysis
[BNL-24781] N79-24504

INDUSTRIAL PLANTS
Conceptual design for advanced coal liquefaction commercial plant
[FE-2251-52] N79-24182

INDUSTRIAL WASTES
Identification of organic compounds in industrial effluent discharges
[PB-291900/9] N79-24111
Land application studies of industrial waste oils and solvents
[DP-MS-78-55] N79-24524
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908

INELASTIC SCATTERING
Neutron scattering on even isotopes of tin
N79-24870

INERTIAL GUIDANCE
Precise terrestrial time: A means for improved ballistic missile guidance analysis
N79-24736

INFERENCE
Inference and decision making based on interval-valued probability
N79-24717

INFORMATION MANAGEMENT
An investigation of a human information processing model for decision making
[AD-A065912] N79-24890
A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930

INFORMATION RETRIEVAL
An automated retrieval system for frequency allocation information
[PB-291600/5] N79-24251

INFORMATION SYSTEMS
Geographical information systems: A review
[PB-290748/3] N79-24424

INFRARED DETECTORS
Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582
Gallium-doped germanium, evaluation of photoconductors, part 1
[NASA-CR-152222] N79-24875

INFRARED LASERS
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221
Tuned diode laser measurements of atmospheric absorption profiles in the 4.5 micrometers to 5.0 micrometers region
[AD-A066159] N79-24584
Calculations on isotope separation by laser induced photodissociation of polyatomic molecules
[COO-4294-2] N79-24800

INFRARED SPECTROSCOPY
ATMOS Spacelab 1 science investigation
[NASA-TM-80465] N79-24568

INFRARED TRACKING
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221
Automatic target hand-off for non-compatible imaging systems
[AD-A065525] N79-24222

INHIBITORS
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158

INHOMOGENEITY
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
N79-24204

INLAND WATERS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411

INLET FLOW
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969

INLET NOZZLES
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911

INORGANIC CHEMISTRY
Research in fluorine chemistry
[AD-A065527] N79-24099

INPUT/OUTPUT ROUTINES
Routing to minimize the maximum congestion in a communication network
[AD-A066110] N79-24225

INSERTION
Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646

INSTALLING
Standard engineering installation package. Terminal VHF Omnidirectional Range [TVOR] system an/FRN-41
[AD-A065932] N79-23941

INSTRUMENT COMPENSATION
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096

INSULATION
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055

INSULATORS
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031

INTAKE SYSTEMS
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911

INTEGRAL CALCULUS
Numerical calculations of periodic gravity-capillary waves
N79-24287

INTEGRAL EQUATIONS
An integral-equation approach to ELF propagation in a non-stratified earth-ionosphere waveguide
[AD-A066097] N79-24230

INTEGRATED CIRCUITS
GaAs waveguide detector array for an IOC spectrum analyzer
[AD-A065824] N79-24265
Electrical characterization of linear integrated circuits
[AD-A065997] N79-24268

INTEGRATED OPTICS
Broadband zinc oxide transducer for integrated optics
[AD-A062851] N79-24827

INTERCOSMOS SATELLITES
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
Polish Interkosmos participation described
N79-23991

INTERFACIAL ENERGY
Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing
N79-24858

INTERFEROMETRY
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838

INTERGALACTIC MEDIA
An investigation of the intergalactic medium via the 21 cm line of neutral hydrogen
N79-24922
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934

INTERMOLECULAR FORCES
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments
N79-24787

INTERNAL COMBUSTION ENGINES
Preliminary investigation of the nonsteady combustion and flow processes of the Naval Academy Heat Balanced Engine [NAHBE]
[AD-A066085] N79-24101
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345

INTERNATIONAL COOPERATION
Development of an airborne military system [MRCA system]
[MBB-UFE-1322-O] N79-23904
Polish Interkosmos participation described
N79-23991
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999
Seismic discrimination
[AD-A065574] N79-24578

INTERNATIONAL SUN EARTH EXPLORER 1
Spacecraft potential control on ISEE-1
N79-24020

INTERNATIONAL SUN EARTH EXPLORER 3
Contingency study for the third international Sun-Earth Explorer [ISEE-3] satellite
[NASA-CR-159931] N79-23996

INTERPLANETARY SPACE
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935

INTERVALS
Interval counts and threshold numbers of graphs
N79-24689
Piecewise polynomials for the probability of clustering on the unit interval
N79-24714

INTRAMOLECULAR STRUCTURES
A study of miscibility in blends of polycarbonate with polyesters
N79-24150

INVENTORIES
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory --- for the demographic mapping program
[LBL-8707] N79-24894

INVERSIONS
Spectral and scattering inverse problems
[PM/78/4] N79-24244
A method for waveform inversion of body-wave seismograms
N79-24558

INVERTERS
Module failure isolation circuit for paralleled inverters --- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254

INVISCID FLOW
Numerical calculation of inviscid transonic flow through rotors and fans
N79-23906
Rotational flows in electrically conducting and non-conducting fluids
N79-24289

IODINE COMPOUNDS
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures
[NASA-CASE-ARC-11241-1] N79-24153

ION ACOUSTIC WAVES
Propagation of ion acoustic cnoidal wave
[IPPJ-367] N79-24837

ION ATOM INTERACTIONS
Ion-molecule interactions of atmospheric importance
N79-24551

ION BEAMS
Ion beam sputter deposition of fluoropolymers
[NASA-CASE-LEW-13122-1] N79-24154

ION DISTRIBUTION
Distribution of positive ion species above a diffuse midnight aurora
N79-24550

ION ENGINES
Operations of the ATS-6 ion engine
N79-24007
Mechanisms of magnetoplasmadynamic arcjet acceleration processes
[AD-A065617] N79-24060

ION EXCHANGING
Fundamentals of ordinary ion exchange
N79-24094

ION IMPLANTATION
Development of pulsed processes for the manufacture of solar cells
[NASA-CR-158676] N79-24450
Advanced archival memory
[AD-A066298] N79-24667
Characterization and growth of epitaxial layers of GaAs exhibiting high resistivity for ionic implantation
[LEP-78/19.SME-441-H] N79-24881

ION IRRADIATION
Continuum absorption coefficient of atoms and ions
[NASA-CR-158536] N79-24791

Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing
N79-24858

ION PROBES
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098

ION PROPULSION
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029

ION SCATTERING
Scattering of Li ions on nickel single crystal planes in the 10-50eV energy range: Experiment and computer simulation
[MPIS-16/1977] N79-24134
Channeling of charged particles
N79-24945

ION SOURCES
Studies of calcium isotope fractionation found in nature and produced during ion sputtering
N79-24927

ION TRAPS [INSTRUMENTATION]
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784

IONIC COLLISIONS
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions
N79-24782
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784

IONIC MOBILITY
Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857

IONIZATION CROSS SECTIONS
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions
N79-24782

IONIZING RADIATION
Metal-nitride-oxide-semiconductor detector for an ionizing radiation dosimeter
[AD-A065995] N79-24267

IONOGRAMS
Studies in ionospheric ray tracing
[CSIR-R-MAG-5/17] N79-24573

IONOSPHERE
Ionspheric electrodynamics and its coupling to the magnetosphere
N79-24549
A suite of programs for handling ionospheric data
[PEL-REPORT-628] N79-24566
Auroral magnetosphere-ionosphere coupling: A brief topical review
[NASA-CR-158662] N79-24572
The photoelectron flux in the earth's ionosphere at energies in the vicinity of photoionization peaks
[AD-A062310] N79-24580
Summary of airplane electric field measurements as part of ionospheric electric field mapping investigation, Thompson, Manitoba, August 1978
[AD-A066304] N79-24583
Electronics for a rocket borne quadrupole cluster ion mass filter
[AD-A066289] N79-24587
Research activities of the Institute of Extraterrestrial Physics --- plasma and particle phenomena
[MPI-PAE-EXTRATERR-141] N79-24936

IONOSPHERIC COMPOSITION
Anomaly of the composition of the F-2 equatorial region of the ionosphere during the hours after sunset according to data from the mass-spectrometer experiment on the Cosmos-274
[NASA-TM-75615] N79-24565

IONOSPHERIC DISTURBANCES
Comparison of signal scintillation models
[AD-A066102] N79-24227
A review of recent results on spread F theory
[AD-A066175] N79-24233
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577
Low-energy particle experiment
[AD-A066150] N79-24840

IONOSPHERIC DRIFT
Prediction of ion drift effects on spacecraft floating potentials
N79-24015

IONOSPHERIC PROPAGATION
Comparative equatorial scintillation morphology: American and pacific sectors
[AD-A066094] N79-24224
An integral-equation approach to ELF propagation in a non-stratified earth-ionosphere waveguide
[AD-A066097] N79-24230
Studies in ionospheric ray tracing
[CSIR-R-MAG-5/17] N79-24573

IOWA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481

IRON
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125

IRON ALLOYS
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764

IRON COMPOUNDS
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440

IRRADIATION
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
Evaluating strength and ductility of irradiated zircaloy, task 5
[PB-291511/4] N79-24142
A study of the Galerkin-Dorodnitsyn method applied to a three-dimensional, quasi-steady melting problem with a moving irradiation source
N79-24874

IRRIGATION
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429

ISOCHORIC PROCESSES
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087

ISOTOPE SEPARATION
Calculations on isotope separation by laser induced photodissociation of polyatomic molecules
[COO-4294-2] N79-24800

ITALY
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202

ITERATIVE SOLUTION
Polynomial representations and an iterative procedure for filter realization
N79-24255
A method for waveform inversion of body-wave seismograms
N79-24558
Existence and uniqueness of positive solutions of a nonlinear integral solutions of a nonlinear integral solution
N79-24685

J

J-85 ENGINE
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968

JAPAN
Time synchronization via the transit satellite at Mizusawa
N79-24752

JET AIRCRAFT NOISE
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770
Detection of low flying aircraft by acoustical means
[REPT-8-78] N79-24779

JET ENGINE FUELS
Stability characteristics of hydrocarbon fuels from alternative sources
[BETC/RI-78/23] N79-24178

JET MIXING FLOW
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770

JET VANES
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971

JOINTS [ANATOMY]
Spacesuit mobility knee joints
[NASA-CASE-ARC-11058-2] N79-24651

JOINTS [JUNCTIONS]
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066
Application of Nitinol to high stiffness structural joints
[AD-A065561] N79-24377
Bolted joint fatigue programme. Volume 1. Stage 1, sections 1 to 6
[AD-A064080] N79-24380

JORDAN FORM
An interactive classical control design algorithm for multivariable systems in state-space form
N79-24670

JOSEPHSON JUNCTIONS
Cylindrical Josephson tunneling
N79-24871

JUPITER ATMOSPHERE
Barotropic and baroclinic instabilities in jupiter's zonal flow
N79-24926

K

KANSAS
Temporal and spatial distribution of humidity in a small city
N79-24599

KARST
Types of karst, with emphasis on cover beds in their classification and development
N79-24556

KENTUCKY
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410

KINEMATICS
Evolution of the rotation of an artificial earth satellite under the influence of a perturbing moment which is constant in fixed axes
[NASA-TM-75614] N79-23995
Multi-Regge factorization in inclusive two-particle production
[ILL-[TH]-79-14] N79-24793
A photometric and kinematic study of the barred spiral galaxy NGC 253
N79-24923

KINETIC ENERGY
Further developments in simple total energy sensors
N79-23900
How accurate is NETTO
N79-23901

KINETICS
Mass transfer and kinetic studies on rotating electrodes
N79-24091
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts
N79-24092

KOLMOGOROFF THEORY
Calculation of the Kolmogorov entropy for motion along a stochastic magnetic field
[PPPL-1523] N79-24765

L

LAGRANGE MULTIPLIERS
Polynomial representations and an iterative procedure for filter realization
N79-24255

LAMINAR FLOW
Further developments in simple total energy sensors
N79-23900

LAMINAR MIXING
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920

LAMINATES
Test and evaluation of split ring shear connectors in laminated wood and laminated wood bolts
[AD-A066323] N79-24381

LAND USE
A systems procedure for land use and water quality planning in a rural watershed
N79-24406
Land application studies of industrial waste oils and solvents
[DP-MS-78-55] N79-24524
Emission density zoning guidebook. A technical guide to maintaining air quality standards through land-use-based emission limits
[PB-290657/6] N79-24579

LANDAU DAMPING
A perturbation expansion for the nonlinear Schroedinger equation with application to the influence of nonlinear Landrau damping
[CTH-IEFT/PP-1977-12] N79-24845

LANDING GEAR
An electric control for an electrohydraulic active control aircraft landing gear
[NASA-CR-3113] N79-23948
LANDSAT SATELLITES
Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis
N79-24407
Instrumentation and data processing used in Earth Resources Technology Satellites [ERTS], volume 2. A bibliography with abstracts
[NTIS/PS-79/0206/7] N79-24430
LARGE AREA CROP INVENTORY EXPERIMENT
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
Large Area Crop Inventory Experiment [LACIE]. Development of procedure M for multicrop inventory, with tests of a spring-wheat configuration
[E79-10197] N79-24416
LARGE SCALE INTEGRATION
Microprocessors and LSI microprocessor sets as the component base of modern digital systems
N79-24942
LARGE SPACE STRUCTURES
Environmental interaction implications for large space systems
N79-24027
LASER ANEMOMETERS
Experimental laser anemometry and analysis of electromagnetic waves in moving media
N79-24328
LASER APPLICATIONS
Cytochemical study related to laser application
[AD-A065671] N79-24335
Tuned diode laser measurements of atmospheric absorption profiles in the 4.5 micrometers to 5.0 micrometers region
[AD-A066159] N79-24584
The scanning optical microscope
[OUEL-1243/78] N79-24829
LASER CAVITIES
Numerical model development for laser cavity flowfields --- subroutine package for a variety of gas dynamics problems
[AD-A065836] N79-24336
LASER MATERIALS
Multistep energy migration and radiationless relaxation processes in phosphor and laser crystals
[AD-A066086] N79-24334
LASER OUTPUTS
Digital recording using hologram arrays: Laser-beam deflection and modulation
[BBC-RD-1979/6] N79-24320
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339
LASER PLASMA INTERACTIONS
Interpretation of enhanced laser-plasma backscattering due to prepulse radiation
N79-24340
LASER PLASMAS
Study of similarity flows of two component laser produced plasmas
N79-24844
LASER PUMPING
High energy resonance transfer laser study
[AD-A065926] N79-24333
LASER RANGE FINDERS
Nd:YAG development for spaceborne laser ranging system
[NASA-CR-159932] N79-24329
Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930
Lunar laser ranging data deposited in the National Space Science Data Center normal points, filtered observations, and unfiltered photon detections
[NASA-CR-158648] N79-24931
LASER TARGET DESIGNATORS
Development of Precision Optical Path Alignment System [POPAS]
[AD-A065673] N79-24823
LASERS
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338
Differential cross section measurements for electron impact on barium in ground and laser excited states
N79-24785
LATTICE VIBRATIONS
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792
LATTICES [MATHEMATICS]
F-normed ideals of spaces of measurable functions
N79-24686
LAUNCH VEHICLES
Plasma Interaction Experiment [PIX] flight results
N79-24022
LEACHING
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536
LEADING EDGES
Supersonic flow in the area of antisymmetric thin cruciform wings with supersonic leading edges in a horizontal plane, with consideration of flow separation on the edges
[AD-A065993] N79-23929
LEAKAGE
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497
LEARNING THEORY
Learning with imperfectly labeled patterns
[NASA-CR-160183] N79-24697
LEAST SQUARES METHOD
Linear least squares regression algorithm: NMGS2
[PB-290475/3] N79-24678
Non-linear model fitting and function minimisation package
[OUEL-1194/77] N79-24706
LEBESGUE THEOREM
A refinement of Lebesgue's measure decomposition
[CTH-MATH-1978-1] N79-24728
LIE GROUPS
Lie transforms and their use in Hamiltonian perturbation theory
[DOE/ET-0074] N79-24727
LIFT
Generation and breakdown of aerodynamic lift: Physical mechanism
N79-23894
LIGHT [VISIBLE RADIATION]
Automation of an ultraviolet-visible spectrometer
[PB-290831/7] N79-24327
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
LIGHT SCATTERING
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition
N79-24788
Scattering of solar radiation by clouds
[AD-A062828] N79-24826
LIGHT TRANSMISSION
EOMET-77: Atmospheric transmission values derived from photographs of the sea horizon
[AD-A065942] N79-24576
Diversion and modulation of optical energy in graded index multimode fiber optics
[REPT-77-213/R] N79-24822
LINE SPECTRA
An investigation of the intergalactic medium via the 21 cm line of neutral hydrogen
N79-24922
LINEAR PROGRAMMING
Algorithmic and computer code developments for combinatorial and network problems
N79-24679
LINEAR SYSTEMS
Electrical characterization of linear integrated circuits
[AD-A065997] N79-24268
Some observations on the random response of linear and nonlinear dynamical systems
[PB-290808/5] N79-24596
Linear least squares regression algorithm: NMGS2
[PB-290475/3] N79-24678
Design of signal synthesis model reference adaptive control systems for linear and nonlinear unknown plants
N79-24680
Robust stability of linear systems: Some computational considerations
[NASA-CR-158620] N79-24695
A Nyquist type criterion for input/output stability of linear time-invariant systems
[OUEL-1240/78] N79-24724
LINING PROCESSES
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908
LININGS
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
LIQUID CRYSTALS
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition
N79-24788
A test of curvature elasticity above the nematic-smectic A phase transition
N79-24859
LIQUID HELIUM
The viscosity of normal and superfluid helium three
N79-24861
Superfluid 3He in narrow cylinders --- nuclear magnetic resonance
N79-24873
LIQUID HELIUM 2
An investigation of effects associated with thermal counterflow in rotating superfluid helium
N79-24869
LIQUID METALS
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
LIQUID-LIQUID INTERFACES
Gravity waves and diffusion in a liquid covered by a superficial film
[REPT-77-3] N79-24310
LIQUID-VAPOR EQUILIBRIUM
Phase equilibrium and volumetric properties of coal-derived fluids
[FE-2278-9] N79-24179
LIQUIDS
Phase equilibrium and volumetric properties of coal-derived fluids
[FE-2278-9] N79-24179
Chemical and optical studies of heat transfer fluids containing solar energy absorbers
[MLM-2549[OP]] N79-24505
Consequences of the renormalization group for the thermodynamics of fluids near the critical point
N79-24884
LITHIUM
Scattering of Li ions on nickel single crystal planes in the 10-50eV energy range: Experiment and computer simulation
[MPIS-16/1977] N79-24134
Energy storage with ambient temperature rechargeable lithium batteries
[PB-290934/9] N79-24518
LITHIUM COMPOUNDS
The reaction of phenyllithium with poly(dichlorophosphazene)
[AD-A066183] N79-24165
LOAD DISTRIBUTION [FORCES]
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923
LOADS [FORCES]
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
LOGARITHMS
Optimization of the second order logarithmic machine economics problems by extended geometric programming
N79-24194
Error analysis of digital filters with logarithmic number system
N79-24660
LOGIC CIRCUITS
Logic circuit simulation and automatic fabrication
[BDX-613-2070-REV] N79-24278
LONG TERM EFFECTS
Preliminary long-term stability criteria for compressed air energy storage caverns in salt domes
[PNL-2871] N79-24487
LORENTZ TRANSFORMATIONS
Neutrinos and long-range weak forces in cosmology
N79-24882
LOUISIANA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
A study of ozone concentrations in Southern Louisiana
[PB-291823/3] N79-24598
LOW ALTITUDE
Detection of low flying aircraft by acoustical means
[REPT-8-78] N79-24779
LOW COST
The array automated assembly task for the low cost solar array project, phase 2
[NASA-CR-158538] N79-24469
LOW FREQUENCIES
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247

LOW SPEED
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
Low-speed single-element airfoil synthesis N79-23890
Generation and breakdown of aerodynamic lift: Physical mechanism N79-23894
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control N79-23895
LOW TEMPERATURE PHYSICS
Low temperature properties of bismuth films in large electric and magnetic fields N79-24867
LUBRICATING OILS
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158
Aircraft engine oil analysis by neutron activation techniques
[AD-A066202] N79-24169
LUBRICATION
Hydrodynamic lubrication with wear and asperity contact in mechanical face seals
[AD-A065924] N79-24357
LUMINAIRES
Optimization and application of microwave-excited discharges N79-24830
LUNAR LANDING
Apollo 11: A good ending to a bad decade
[NASA-NEWS-RELEASE-79-73] N79-23986
LUNAR RANGEFINDING
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930
Lunar laser ranging data deposited in the National Space Science Data Center normal points, filtered observations, and unfiltered photon detections
[NASA-CR-158648] N79-24931
LUNAR ROCKS
Petrographic and petrological studies of lunar rocks
[NASA-CR-159921] N79-24929

M

MAGNESIUM
Sensitivity of burning rate to initial temperature for a binary magnesium-sodium nitrate mix
[AD-A066119] N79-24175
MAGNESIUM COMPOUNDS
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin N79-24868
MAGNETIC ANOMALIES
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins N79-24560
MAGNETIC CHARGE DENSITY
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition N79-24788
MAGNETIC CIRCUITS
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
MAGNETIC DOMAINS
Magnetic bubble traveling-wave amplifier
[AD-A065512] N79-24269
MAGNETIC EFFECTS
Plasma particle trajectories around spacecraft propelled by ion thrusters N79-24029
MAGNETIC FIELD CONFIGURATIONS
Magnetization effects in superconducting accelerator magnets
[BNL-24939] N79-24815
MAGNETIC FIELDS
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
Calculation of the Kolmogorov entropy for motion along a stochastic magnetic field
[PPPL-1523] N79-24765
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838
ELMO Bumpy Torus
[ORNL/TM-6743] N79-24842
Influence of globalmagnetic perturbations on plasma behavior in Elmo Bumpy Torus
[ORNL/TM-6704] N79-24843
Cylindrical Josephson tunneling N79-24871
MAGNETIC INDUCTION
The magnetic induction of the system consisting of a coil and a ferromagnetic spherical body
[AD-A065809] N79-24266
MAGNETIC MATERIALS
Local electronic properties of dilute magnetic alloys N79-24114
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
MAGNETIC PROPERTIES
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions N79-24855
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses N79-24856
Low temperature properties of bismuth films in large electric and magnetic fields N79-24867
A magnetic study of the spotted UV Ceti flare stars and related late-type dwarfs N79-24918
MAGNETIC SHIELDING
Magnetic shielding of large high-power-satellite solar arrays using internal currents N79-24026
Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks N79-24738
MAGNETIC STORMS
Charging analysis of the SCATHA satellite N79-24012
Spacecraft charging results for the DSCS-3 satellite N79-24014
A combined spacecraft charging and pulsed X-ray simulation facility N79-24054
MAGNETIC SUSPENSION
Measurement of the drag of slender cones in hypersonic flow at low Reynolds numbers using a magnetic suspension and balance
[OUEL-1235/78] N79-23938
MAGNETIZATION
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125
Magnetization effects in superconducting accelerator magnets
[BNL-24939] N79-24815
MAGNETOHYDRODYNAMIC GENERATORS
Performance optimization of an MHD generator with physical constraints
[NASA-TM-79172] N79-24446
MAGNETOHYDRODYNAMIC STABILITY
Stabilization of magnetohydrodynamic instabilities in a current-carrying stellarator
[IPPJ-368] N79-24836
Study of similarity flows of two component laser produced plasmas N79-24844
MAGNETOHYDRODYNAMIC WAVES
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838
MAGNETOHYDRODYNAMICS
Rotational flows in electrically conducting and nonconducting fluids N79-24289
Power industry application of MHD technology N79-24949
MAGNETOMETERS
Investigation of micropulsation activity
[AD-A066344] N79-24668
MAGNETOSPHERE
Spacecraft charging standard N79-24050
Spacecraft charging modeling development and validation study N79-24051
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2 N79-24056
Ionspheric electrodynamics and its coupling to the magnetosphere N79-24549
Auroral magnetosphere-ionosphere coupling: A brief topical review
[NASA-CR-158662] N79-24572
Low-energy particle experiment
[AD-A066150] N79-24840
Research activities of the Institute of Extraterrestrial Physics --- plasma and particle phenomena
[MPI-PAE-EXTRATERR-141] N79-24936
MAGNETOSTRICTION
Local site distortion model of magnetostriction
[AD-A066250] N79-24763
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764
MAMMALS
Temperature dependence of the velocity of ultrasound in mammalian tissue N79-24767
MAN ENVIRONMENT INTERACTIONS
An analysis of air pollution and its health effects: Washington, D. C. metropolitan area
[PB-290618/8] N79-24545
MAN MACHINE SYSTEMS
Analytical methods for biotechnological design of man machine systems: Work on system ergonomy
[FB-28] N79-24315
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657
MANAGEMENT INFORMATION SYSTEMS
An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889
Evaluation of computer aided indexing of information for support of contract appeals
[AD-A065835] N79-24893
MANAGEMENT METHODS
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives --- economic analysis N79-24813
MANAGEMENT PLANNING
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation N79-24052
A systems procedure for land use and water quality planning in a rural watershed N79-24406
Research at Sandia Laboratories for Solar Thermal Large Power Systems Program
[SAND-78-8051] N79-24510
Mathematical programming methods for urban transportation networks N79-24897
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904
MANAGEMENT SYSTEMS
Computer resource performance management A total data centre approach
[CSIR-TWISK-54] N79-24665
MANGANESE COMPOUNDS
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440
MANIFOLDS
Method for determining the state of a fuel mixture at the inlet manifold of an M 207 motor under non-adiabatic conditions
[BLL-RTS-11509] N79-24341
MANIPULATORS
Compact artificial hand
[NASA-CASE-NPO-13906-1] N79-24652
Proximity-vision system for protoflight manipulator arm
[NASA-CR-158652] N79-24658
MANUALS
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recover from small ships. Volume 2: Appendices
[AD-A066173] N79-23955
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527
Guides for undertaking a neighborhood transportation needs assessment: Users manual
[PB-290589/1] N79-24909
MANUFACTURING
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
MAPPING
Potential mapping with charged-particle beams N79-24038
Some properties of condensing maps
[AD-A065630] N79-24726
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory --- for the demographic mapping program
[LBL-8707] N79-24894
MAPS
Geographical information systems: A review
[PB-290748/3] N79-24424
Summary of airplane electric field measurements as part of ionospheric electric field mapping investigation, Thompson, Manitoba, August 1978
[AD-A066304] N79-24583
MARINE BIOLOGY
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474

MARINE ENVIRONMENTS
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins
N79-24560
MARSHLANDS
Protection, cleanup and restoration of salt marshes endangered by oil spills: A procedural manual
[PB-291958/7] N79-24522
MASS SPECTROMETERS
Electronics for a rocket borne quadrupole cluster ion mass filter
[AD-A066289] N79-24587
MASS SPECTROSCOPY
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098
MASS TRANSFER
Mass transfer and kinetic studies on rotating electrodes
N79-24091
MATERIAL BALANCE
A preliminary analysis nitrous oxide [N2O] including a materials balance
[PB-290653/5] N79-24597
MATERIALS HANDLING
Development and evaluation of die and container materials. Low cost silicon solar array project
[NASA-CR-158670] N79-24351
MATERIALS RECOVERY
Studies in the theory and practices of foam flotation techniques
N79-24077
MATHEMATICAL LOGIC
Existence and approximations for saddle-point problems with application to nonlinear incompressible elasticity
N79-24365
MATHEMATICAL MODELS
Numerical solution of the two-dimensional nonsteady mean Navier-Stokes equations for incompressible flows past arbitrary shaped bodies
N79-23905
The production function and airframe cost estimation
[AD-A065570] N79-23952
Engine rotor dynamics, synchronous and nonsynchronous whirl control
[AD-A066093] N79-23975
A simplified rotor system mathematical model for piloted flight dynamics simulation
[NASA-TM-78575] N79-23977
Model for breakdown process in dielectric discharges
N79-24044
Analysis of coke combustion during in-situ oil recovery
N79-24095
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096
Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371
Development of a model and computer code to describe solar grade silicon production processes
[NASA-CR-158679] N79-24448
Method for the comparative economic assessment of energy storage systems
[BNL-25291] N79-24509
Numerical study of the effects of complex terrain on dynamics of airflow and pollution dispersion
[CONF-790101-4] N79-24523
Modeling of simulated photochemical smog with kinetic mechanisms, Volume 1
[PB-290507/3] N79-24531
Generalized ray models of strong ground motion
N79-24557
Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657
The power of sequential model selection procedures
N79-24715
Internal and external models of variable parameter filters
[CEPHAG-44/77] N79-24777
A theoretical study into the spatial distribution of atoms surrounding an individual solute particle vaporizing in an analytical flame
[AD-A066182] N79-24796
Simulation and control of advanced wastewater treatment systems
N79-24895
MATHEMATICAL PROGRAMMING
Wing shape optimization for maximum cross-country speed, with mathematical programming
N79-23899
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
Mathematical programming methods for urban transportation networks
N79-24897
MATRIX METHODS
On large displacement-small strain analysis of structures with rotational degrees of freedom
[ISD-247] N79-24392
Note on large strain applications of a modified constant strain finite element method
[ISD-248] N79-24393
On the natural factor in nonlinear analysis
[ISD-242] N79-24702
MEAN
Hypothesis testing for the common mean of two normal distributions with unknown variances when the null and alternative hypotheses are separated by a zone of indifference
N79-24713
MEASURE AND INTEGRATION
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643
Existence and uniqueness of positive solutions of a nonlinear integral solutions of a nonlinear integral solution
N79-24685
Construction of integral quadratic forms
N79-24691
L sub p-intensities of random measures
[CTH-MATH-1978-2] N79-24704
Projections and measures
N79-24725
A refinement of Lebesgue's measure decomposition
[CTH-MATH-1978-1] N79-24728
MEASUREMENT
A contemporary approach to the problem of determining physical parameters according to the results of measurements
[NASA-TM-75616] N79-24696
MEASURING INSTRUMENTS
Measurement of resonance vibrations of turbine blades with the Elura device
[AD-A066122] N79-23976
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
Measurement assurance for gage blocks
[PB-292020/5] N79-24200
Operating manual for the RRL 8 channel data logger
[NASA-CR-158633] N79-24671
MECHANICAL DRIVES
Driveshaft alignment indicator
[AD-A065988] N79-23973
MECHANICAL PROPERTIES
Generation and breakdown of aerodynamic lift: Physical mechanism
N79-23894
Structural properties of adhesives. Volume 2: Appendices. A: The symmetric lap shear test. B: Adhesive joint fabrication and test specifications
[AD-A065521] N79-24156
Contact phenomena. 1: Stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components
[ESDU-78035] N79-24369
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438
A study of molecular clouds near supernova remnants
N79-24924
MEDIA
Electromagnetic fields in nonuniform multi-layered structures with engineering applications
[AD-A065515] N79-24228
MELTING
A study of the Galerkin-Dorodnitsyn method applied to a three-dimensional, quasi-steady melting problem with a moving irradiation source
N79-24874
MEMBRANES
Selective transport of sulfur-dioxide through polymer membranes
N79-24089
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110
Simple formulae for calculating the vibrational frequencies of plates, shells and membranes
[ARL-STRUC-REPT-371] N79-24374
The effects of high nitrogen tensions of the properties of neuronal membranes and synaptic transmission
[AD-A063856] N79-24647
MENTAL PERFORMANCE
Analyzing the solution of problems involving three-dimensional geometric figures: An exploratory study
N79-24687
An investigation of a human information processing model for decision making
[AD-A065912] N79-24890
MERCURY SPACECRAFT
Mercury orbiter transport study
[NASA-CR-158658] N79-23987
MERCURY VAPOR
Measurements of the differential scattering cross sections of electron excited Na on Hg
[MPIS-13/1977] N79-24804
MESOMETEOROLOGY
A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems
N79-24553
MESON-NUCLEON INTERACTIONS
Unitarity constraints on meson-nucleon helicity-flip amplitudes and slope of the diffraction peak
[PM/78/7] N79-24802
MESOSPHERE
Study of the influence of negative ions on the incoherent scattering spectra --- mesosphere
[CEPHAG-45/77] N79-24242
METABOLISM
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
METAL COATINGS
Electrodeposition painting of metal substrates: Pinholing in surface films
[AD-A065968] N79-24160
METAL COMPOUNDS
Pathways for intramolecular carbonyl exchange in some metal carbonyl complexes
N79-24115
METAL FATIGUE
Hydrogen embrittlement of metals, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0177/0] N79-24135
Hydrogen embrittlement of metals, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/0178/8] N79-24136
Hydrogen embrittlement of metals, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0179/6] N79-24137
Hydrogen embrittlement of metals. Citations from the American Petroleum Institute data base
[NTIS/PS-79/0180/4] N79-24138
Application of electron-beam welding to aviation production --- tests of turbine engine parts welded by electron beam
N79-24940
METAL FILMS
Thermal blanket metallic film groundstrap and second surface mirror vulnerability to arc discharges
N79-24042
Thermal conductivity of granular aluminum
N79-24852
Low temperature properties of bismuth films in large electric and magnetic fields
N79-24867
METAL IONS
Spectroscopic investigation of metal cation reduction at glass surfaces
N79-24079
Nickel coatings achieved without the use of electric current
[BLL-RTS-11605] N79-24113
Observations on the physico-chemical forms of cobalt, manganese, zinc, chromium and iron in sea water enriched or not with organic matter
[DRIC-TRANS-5370] N79-24625
METAL MATRIX COMPOSITES
Composite materials with superplastic matrix
[BLL-RTS-11722] N79-24064
METAL OXIDE SEMICONDUCTORS
Metal-nitride-oxide-semiconductor detector for an ionizing radiation dosimeter
[AD-A065995] N79-24267
METAL OXIDES
Materials and techniques for spacecraft static charge control 2
N79-24034
METAL PLATES
Charging rates of metal-dielectric structures --- with implications for spacecraft
N79-24033
METAL SHEETS
Laser-zone growth in a Ribbon-to-Ribbon [RTR] process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473
METAL SURFACES
Scattering of Li ions on nickel single crystal planes in the 10-50eV energy range: Experiment and computer simulation
[MPIS-16/1977] N79-24134
METAL-METAL BONDING
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds
N79-24076
METALLIC GLASSES
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses
N79-24856

METALLIZING
Metallic xenon
N79-24118
METALS
Simple acoustic emission tests for the detection of corrosion
[AD-A065965] N79-24122
METASTABLE ATOMS
Nitrogen excitation by metastable argon atoms
[LP-170] N79-24850
METEOROLOGICAL CHARTS
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608
METEOROLOGICAL PARAMETERS
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
A primitive equation spectral model for the study of stratospheric sudden warmings
N79-24546
Temporal and spatial distribution of humidity in a small city
N79-24599
Documentation of software in the OL-192 meteorological data reduction program
[AD-A066218] N79-24614
METEOROLOGICAL RADAR
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-[9022.549]]
N79-24602
METEOROLOGICAL SATELLITES
Disturbed versus undisturbed conditions in the Caribbean during the intensification of Hurricane Carmen [1974]
[AD-A065517] N79-24612
METEOROLOGY
Activities of the International Meteorological Institute
[AR-77-78] N79-24590
METHANE
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts
N79-24092
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104
The effect of carbon monoxide and methane on the resistance of tin oxide thin films
N79-24256
METHOD OF CHARACTERISTICS
Airfoil optimization for transonic flow using the methods of finite elements and characteristics
[MBB-UFE-1362-O] N79-23937
METHODOLOGY
Comparison of three experimental methods used in determining the thermal performance of flat-plate solar collectors
N79-24434
An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889
METHYL ALCOHOLS
Fluid bed process studies on selective conversion of methanol to high octane gasoline
[FE-2490-15] N79-24190
METHYL CHLORIDE
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087
METHYL COMPOUNDS
Biodegradable polymer: Synthesis and characterization of methyl- and hydroxyl-containing polyamides, polyfumaramides, and polyenamines
N79-24147
METRIC SPACE
Some properties of condensing maps
[AD-A065630] N79-24726
MICHIGAN
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
MICROBIOLOGY
Electrochemical detection device --- for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073
MICROELECTRONICS
Inductorless narrow-band filter/amplifier
[NASA-CASE-GSC-12410-1] N79-24260
Electrical characterization of linear integrated circuits
[AD-A065997] N79-24268
Semiconductor measurement technology: Microelectronic Processing Laboratory at NBS
[PB-291790/4] N79-24283
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
MICROPHONES
High-temperature microphone system --- for measuring pressure fluctuations in gases at high temperature
[NASA-CASE-LAR-12375-1] N79-24203
MICROPROCESSORS
The application of microprocessor technology to in-flight computation
N79-23902
Real-time video filtering with bit-slice microprogrammable processors
N79-24207
A programmable power processor for a 25-cW power module
[NASA-TM-78215] N79-24441
A rocket-borne data-manipulation experiment using a microprocessor
[NASA-CR-158647] N79-24571
Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615
Computational design alternatives with microprocessor-based systems
N79-24664
Multimode CPU design study
[AD-A066241] N79-24666
Microprocessors and LSI microprocessor sets as the component base of modern digital systems
N79-24942
MICROPROGRAMMING
Real-time video filtering with bit-slice microprogrammable processors
N79-24207
MICROPULSATIONS
Investigation of micropulsation activity
[AD-A066344] N79-24668
MICROSTRUCTURE
Morphology and mechanism of hydrogen attack in iron-carbon alloys
N79-24117
Effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al
[AD-A066062] N79-24124
Relation of structure to fatigue properties in aluminum-base alloys
[AD-A062698] N79-24127
Corrosion of stainless steel, volume 2. A bibliography with abstracts
[NTIS/PS-79/0208/3] N79-24143
Microstructural study of V2D by X-ray measurements
N79-24854
MICROWAVE EQUIPMENT
Feasibility study of ferrite use at mm waves
[AD-A066178] N79-24235
MICROWAVE RADIOMETERS
Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Evaluation and analysis of Seasat-A scanning multichannel Microwave Radiometer [SMMR] Antenna Pattern Correction [APC] algorithm
[NASA-CR-158674] N79-24420
MICROWAVE SENSORS
Microwave remote sensing laboratory design
[NASA-CR-159015] N79-24419
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data
[NASA-TM-79689] N79-24421
MICROWAVE TRANSMISSION
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 1: Executive summary
[NASA-TM-80354] N79-24435
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 2: Detailed assessment
[NASA-TM-80355] N79-24436
MICROWAVES
Studies on the microwave-induced auditory effect
[PB-290598/2] N79-24648
Optimization and application of microwave-excited discharges
N79-24830
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934
MILITARY AIRCRAFT
Optimum frequencies for aircraft classification
[AD-A065697] N79-24220
MILITARY HELICOPTERS
Nap-of-the-earth communication program for US Army helicopters
[AD-A063089] N79-24232
MILLIMETER WAVES
Feasibility study of ferrite use at mm waves
[AD-A066178] N79-24235
High power millimeter wave amplifier
[AD-A062966] N79-24275
MINES [EXCAVATIONS]
Evaluation of a flywheel-powered shuttle car
[FE-8890] N79-24488
MINICOMPUTERS
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0312/3] N79-23959
Aerospace computer systems. Part 1: Avionics applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0313/1] N79-23960
Evaluation of computer aided indexing of information for support of contract appeals
[AD-A065835] N79-24893
MINIMUM DRAG
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923
MINING
Development of sensitized pick coal interface detector system
[NASA-CR-161225] N79-24417
MINNESOTA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
MIRRORS
Heliostat glass survey and analysis
[PNL-2868] N79-24170
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
Heliostat for astronomical usage
[NASA-TM-75481] N79-24920
MISSILE COMPONENTS
Application of Nitinol to high stiffness structural joints
[AD-A065561] N79-24377
MISSILE CONTROL
Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957
Aerospace computer systems. Part 2: Space and guided missile applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0314/9] N79-23961
Aerospace computer systems. Part 2: Space and guided missile applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0315/6] N79-23962
MISSILE TRACKING
Automatic target hand-off for non-compatible imaging systems
[AD-A065525] N79-24222
MISSILES
Optical pattern recognition for terminal guidance guidance
[AD-A062821] N79-23942
MISSION PLANNING
Advanced planetary studies
[NASA-CR-158657] N79-24915
Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916
MISSISSIPPI
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
MISSOURI
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
MIXTURES
The effects of finite size on the critical behavior of fluid films
N79-24288
Investigations into mixture preparation and combustion in the hydrogen engine
[BLL-RTS-11807] N79-24346
MODAL RESPONSE
Resonant modes of a toroidal plasma in the large major radius approximation --- radiation heating
[CTH-IEFT/PP-1977-13] N79-24846
MODELS
A long term model of circulation --- human body
[NASA-CR-147674] N79-24636
MODULES
Development of high efficiency [14%] solar cell array module
[NASA-CR-158672] N79-24454

MOISTURE CONTENT
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536

MOLECULAR CHAINS
Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168

MOLECULAR COLLISIONS
Eckart frame motions and molecular vibrations — with emphasis on angular motion and angular acceleration
N79-24789
Structural and dynamic considerations in molecular collision theory
[AD-A065531] N79-24794

MOLECULAR ELECTRONICS
Coupling of electronic and vibrational motions in molecules
N79-24790

MOLECULAR ENERGY LEVELS
Theoretical modeling of molecular and electron kinetic processes. Volume 1: Theoretical formulation of analysis and description of computer program
[AD-A066155] N79-24337
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338

MOLECULAR EXCITATION
Excimer potential curves
[AD-A066043] N79-24332

MOLECULAR INTERACTIONS
Ion-molecule interactions of atmospheric importance
N79-24551
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments
N79-24787

MOLECULAR IONS
Fluctuations in active molecular plasmas
[CTH-IEFT/PP-1978-1] N79-24849

MOLECULAR OSCILLATIONS
Coupling of electronic and vibrational motions in molecules
N79-24790

MOLECULAR STRUCTURE
Structure analyses of organic compounds using X-ray crystallographic techniques
N79-24851

MOLECULES
A study of molecular clouds near supernova remnants
N79-24924

MOLYBDENUM
Treatment of molybdenite ore using a 2 kW solar furnace
[LA-UR-79-6] N79-24478

MOMENTUM TRANSFER
Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607

MONOPULSE RADAR
The monopulse performance of an optical heterodyne detector with varying LO distributions
[AD-A066253] N79-24238

MOTION STABILITY
The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere
N79-24547

MOTOR VEHICLES
Impact tests on crash helmets for motor cyclists
[AD-A065966] N79-24655

MOVING TARGET INDICATORS
Estimation of aircraft target motion using pattern recognition orientation measurements
[AD-A066195] N79-24682

MRCA AIRCRAFT
Development of an airborne military system [MRCA system]
[MBB-UFE-1322-O] N79-23904

MULTICHANNEL COMMUNICATION
Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Priority loss systems: Unequal holding times
[AD-A066245] N79-24239

MULTIPATH TRANSMISSION
SEATRACKS: A 35 GHz monopulse tracking radar
[AD-A065933] N79-24219

MULTIPROCESSING (COMPUTERS)
Parallel algorithms for multiple processor architectures
N79-24663

MULTISPECTRAL BAND SCANNERS
Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis
N79-24407
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418

MUSCULAR FATIGUE
Operator performance and localized muscle fatigue in a simulated space vehicle control
N79-24653

N

NASA PROGRAMS
US civilian space policy
[GPO-42-110] N79-23988

NASTRAN
Standard test rack. Concept definition study. Structural analysis report
[AD-A066247] N79-23998

NAVIER-STOKES EQUATION
Numerical solution of the two-dimensional nonsteady mean Navier-Stokes equations for incompressible flows past arbitrary shaped bodies
N79-23905
Numerical solution of Navier-Stokes equations for wide range of two dimensional incompressible internal flow problems using boundary-fitted curvilinear coordinates
N79-24290

NAVIGATION
Relationships between the performance of time/frequency standards and navigation/communication systems
N79-24734

NAVIGATION TECHNOLOGY SATELLITES
Submicrosecond comparisons of time standards via the Navigation Technology Satellites [NTS]
N79-24756
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757

NAVSTAR SATELLITES
The NAVSTAR global positioning system: A program with many uncertainties
[PB-291438/0] N79-23944
Rubidium frequency standard test program for NAVSTAR GPS
N79-24745
Clock performance as a critical parameter in navigation satellite systems
N79-24750

NAVY
A review of the US Navy's Precise Time and Time Interval [PTTI] program
N79-24743
Transit satellite system timing capabilities
N79-24751

NEAR FIELDS
High frequency near field scattering by an elliptic disk
[AD-A065586] N79-24214

NEBRASKA
Stratification and sample selection for multicrop experiments — Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410

NECK [ANATOMY]
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627

NEGATIVE IONS
Study of the influence of negative ions on the incoherent scattering spectra — mesophere
[CEPHAG-45/77] N79-24242

NEODYMIUM LASERS
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221

NEON
Relaxation of excited neon atoms in their parent gas
N79-24786

NETWORK SYNTHESIS
Mathematical programming methods for urban transportation networks
N79-24897

NEUROMUSCULAR TRANSMISSION
A discrete parameter model of the head and neck with neuromuscular feedback
N79-24627

NEURONS
The effects of high nitrogen tensions of the properties of neuronal membranes and synaptic transmission
[AD-A063856] N79-24647

NEUTRINOS
Neutrinos and long-range weak forces in cosmology
N79-24882

NEUTRON ACTIVATION ANALYSIS
Aircraft engine oil analysis by neutron activation techniques
[AD-A066202] N79-24169

NEUTRON SCATTERING
Neutron scattering on even isotopes of tin
N79-24870

NEUTRON STARS
Fluid spheres in general relativity: Exact solutions and applications to astrophysics — neutron stars, stellar mass and Einstein's field equations
N79-24886

NEW HAMPSHIRE
Solar project cost report: Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/60] N79-24484
Solar project description. Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/50] N79-24499

NEW MEXICO
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426

NICKEL
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts
N79-24092
Scattering of Li ions on nickel single crystal planes in the 10-50eV energy range: Experiment and computer simulation
[MPIS-16/1977] N79-24134

NICKEL ALLOYS
Low-cost directionally-solidified turbine blades, volume 1
[NASA-CR-159464] N79-24121
Effects of hot forging variables upon microstructure and properties of metals and alloys
[AD-A065674] N79-24123
A study to determine the mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater
[AD-A066257] N79-24130
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
Superalloys, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0220/8] N79-24139
Superalloys, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0221/6] N79-24140
Application of Nitinol to high stiffness structural joints
[AD-A065561] N79-24377

NICKEL COATINGS
Nickel coatings achieved without the use of electric current
[BLL-RTS-11605] N79-24113

NICKEL COMPOUNDS
Nuclear magnetic studies of triethylborane with cobalt and nickel compounds
N79-24116

NIMBUS 5 SATELLITE
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data
[NASA-TM-79689] N79-24421

NIOBIUM
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system
N79-24075

NITINOL ALLOYS
Application of Nitinol to high stiffness structural joints
[AD-A065561] N79-24377

NITRAMINE PROPELLANTS
Solid propellant combustion mechanism research
[AD-A065761] N79-24173

NITRO COMPOUNDS
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164

NITROGEN
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
The effects of high nitrogen tensions of the properties of neuronal membranes and synaptic transmission
[AD-A063856] N79-24647
Nitrogen excitation by metastable argon atoms
[LP-170] N79-24850

NITROUS OXIDES
A preliminary analysis nitrous oxide [N2O] including a materials balance
[PB-290653/5] N79-24597

NOISE INTENSITY
Statistical comparisons of aircraft flyover noise adjustment procedures for different weather conditions
[NASA-TP-1430] N79-24773

NOISE MEASUREMENT
Noise performance of broadband amplifiers for use with electrically small antennas
N79-24208

NOISE POLLUTION
Aircraft sonic boom: Effects on buildings. A bibliography with abstracts
[NTIS/PS-79/0265/3] N79-24201
NOISE REDUCTION
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780
NOISE SPECTRA
Statistical comparisons of aircraft flyover noise adjustment procedures for different weather conditions
[NASA-TP-1430] N79-24773
NOISE TOLERANCE
Stress and fatigue in the driving environment --- physiological and psychological effects of heat and noise experienced inside automobiles N79-24629
Significant characteristics of social response to noise and vibration
[NASA-TM-75412] N79-24888
NONDESTRUCTIVE TESTS
Simple acoustic emission tests for the detection of corrosion
[AD-A065965] N79-24122
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
Improved ultrasonic nondestructive testing of pressure vessels
[NUREG-CR-0581] N79-24361
Activities of the National Bureau of Standards nondestructive evaluation program for fiscal year 1978: Summary
[PB-291946/2] N79-24362
NONEQUILIBRIUM FLOW
Theory of thin wing in a supersonic flow with consideration of the non-equilibrium state of excitation of oscillating degrees of freedom
[AD-A065992] N79-23928
Preliminary investigation of the nonsteady combustion and flow processes of the Naval Academy Heat Balanced Engine [NAHBE]
[AD-A066085] N79-24101
NONEQUILIBRIUM PLASMAS
Study of similarity flows of two component laser produced plasmas N79-24844
NONEQUILIBRIUM THERMODYNAMICS
Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607
NONLINEAR EQUATIONS
Relationship between Dirac and matrix Schroedinger inverse scattering transforms
[PM/78/6] N79-24072
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386
Geometrically nonlinear finite element behavior using buckling mode superposition
[ISD-241] N79-24391
Bifurcation of periodic solutions in functional differential equations N79-24684
Existence and uniqueness of positive solutions of a nonlinear integral solutions of a nonlinear integral solution N79-24685
Some uniqueness problems in nonlinear L sub p-approximation N79-24693
On the natural factor in nonlinear analysis
[ISD-242] N79-24702
Nonlinear evolution equations associated with a massive Dirac system
[PM/78/5] N79-24705
Non-linear model fitting and function minimisation package
[OUEL-1194/77] N79-24706
A theory of anharmonic effects in vibrational nuclei --- nonlinear equations of motion method N79-24809
A perturbation expansion for the nonlinear Schroedinger equation with application to the influence of nonlinear Landrau damping
[CTH-IEFT/PP-1977-12] N79-24845
Coupled nonlinear Schroedinger equations including growth and damping
[CTH-IEFT/PP-1977-14] N79-24847
NONLINEAR OPTICS
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339
NONLINEAR SYSTEMS
Some observations on the random response of linear and nonlinear dynamical systems
[PB-290808/5] N79-24596
Design of signal synthesis model reference adaptive control systems for linear and nonlinear unknown plants N79-24680
Asymptotic stability of a class of nonlinear singularly perturbed systems
[AD-A062957] N79-24701
Nonlinear optical processing with Fabry-Perot interferometers N79-24817
Wave interaction in a beam-plasma system in the presence of dispersion and higher order nonlinear effects
[CTH-IEFT/PP-1977-15] N79-24848
A study of the Galerkin-Dorodnitsyn method applied to a three-dimensional, quasi-steady melting problem with a moving irradiation source N79-24874
NONLINEARITY
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas N79-24730
NONPARAMETRIC STATISTICS
Bivariate nonparametric tests for the one-sample location problem N79-24711
NORMAL DENSITY FUNCTIONS
A Gaussian approximation to the distribution of sample variance for nonnormal populations
[AD-A065738] N79-24699
Hypothesis testing for the common mean of two normal distributions with unknown variances when the null and alternative hypotheses are separated by a zone of indifference N79-24713
NORTH CAROLINA
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891
NORTH DAKOTA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
NOSE CONES
Hardened RV development program. Phase 4: Vehicle recovery technology wind tunnel tests
[AD-A066095] N79-23930
Flame nosetip recovery vehicle flight test series
[AD-A066217] N79-24058
NOSE FINS
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921
NOZZLE DESIGN
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971
NOZZLE GEOMETRY
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911
NUCLEAR EXPLOSIONS
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951
NUCLEAR FUEL BURNUP
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives --- economic analysis N79-24813
NUCLEAR FUEL REPROCESSING
A radiological environs study at a fuel fabrication facility
[PB-291928/0] N79-24530
NUCLEAR FUELS
Radioactive waste disposal: A comparison of alternative nuclear fuel cycles N79-24812
NUCLEAR FUSION
Probe measurement technique in a Tokamak
[BLL-CTO/1563-[9091.9F]] N79-24831
NUCLEAR MAGNETIC RESONANCE
Nuclear magnetic studies of triethylborane with cobalt and nickel compounds N79-24116
NMR studies of synthetic polypeptide structures N79-24146
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses N79-24856
Superfluid 3He in narrow cylinders --- nuclear magnetic resonance N79-24873
NUCLEAR PHYSICS
Translations on USSR science and technology: Physical sciences and technology, no. 66
[JPRS-73337] N79-24941
NUCLEAR POWER REACTORS
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program --- concerning the use of radioisotopic power systems
[LA-7694-PR] N79-24801
NUCLEAR REACTORS
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
NUCLEAR SCATTERING
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations N79-24810
A configuration space study of low energy pion-nucleus scattering N79-24811
NUCLEAR SPIN
Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum N79-24862
NUCLEATION
Polymerization of sicica in aqueous solutions N79-24149
Ion-molecule interactions of atmospheric importance N79-24551
NUCLEI [NUCLEAR PHYSICS]
A theory of anharmonic effects in vibrational nuclei --- nonlinear equations of motion method N79-24809
A configuration space study of low energy pion-nucleus scattering N79-24811
NUCLEON-NUCLEON INTERACTIONS
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations N79-24810
NUMBER THEORY
Error analysis of digital filters with logarithmic number system N79-24660
NUMERICAL ANALYSIS
Numerical calculations of high-altitude differential charging: Preliminary results N79-24016
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies N79-24204
Partially balanced residual effects designs N79-24709
Structural and dynamic considerations in molecular collision theory
[AD-A065531] N79-24794
Numerical simulation of spherically symmetric matter in relativity N79-24883
NUMERICAL FLOW VISUALIZATION
Numerical calculation of inviscid transonic flow through rotors and fans N79-23906
NUTRIENTS
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096
NYQUIST FREQUENCIES
A Nyquist type criterion for input/output stability of linear time-invariant systems
[OUEL-1240/78] N79-24724

O

OCEAN BOTTOM
High speed TV-towing system for project definition study for conception and design of a deep sea towing system with two instrumented exploration instrumental bodies in a tandem configuration for close to sea floor control
[BMFT-FB-M-77-05] N79-24623
Deep ocean reception of acoustic signals emitted by a towed source N79-24766
OCEAN MODELS
A mixed layer model of wind and density driven mixing during a phytoplankton bloom
[DM-24] N79-24619
OCEAN THERMAL ENERGY CONVERSION
OTEC platform configuration and integration study. Volume 2: Technical concept
[DOE/ET-4063-1-VOL-2] N79-24477
OCEANOGRAPHY
Analysis of acoustical effects of receiver and source motions at short ranges in the deep ocean
[AD-A066199] N79-24776
OCEANS
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]] N79-24600

Report to the Congress on ocean dumping research
[PB-292791/1] N79-24913

OCTANE NUMBER
Fluid bed process studies on selective conversion of methanol to high octane gasoline
[FE-2490-15] N79-24190
OFFSHORE PLATFORMS
OTEC platform configuration and integration study. Volume 2: Technical concept
[DOE/ET-4063-1-VOL-2] N79-24477
Effects of changes in upwind surface characteristics of mean wind speed and turbulence near a coastline
[BNL-25178] N79-24616
OHIO
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
OIL POLLUTION
Protection, cleanup and restoration of salt marshes endangered by oil spills: A procedural manual
[PB-291958/7] N79-24522
OIL RECOVERY
Analysis of coke combustion during in-situ oil recovery
N79-24095
Evaluation of flow properties of dilute aqueous polymer solutions for enhanced oil recovery applications
N79-24408
Feasibility and economics of cogeneration in California's thermal enhanced oil recovery operations
[PB-291794/6] N79-24517
OILS
Land application studies of industrial waste oils and solvents
[DP-MS-78-55] N79-24524
OLIVINE
Development of preferred orientation in uniaxially deformed olivine aggregates
N79-24554
OMNIDIRECTIONAL RADIO RANGES
Standard engineering installation package. Terminal VHF Omnidirectional Range [TVOR] system an/FRN-41
[AD-A065932] N79-23941
ONBOARD EQUIPMENT
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0312/3] N79-23959
Aerospace computer systems. Part 1: Avionics applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0313/1] N79-23960
Aerospace computer systems. Part 2: Space and guided missile applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0314/9] N79-23961
Aerospace computer systems. Part 2: Space and guided missile applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0315/6] N79-23962
US Navy development of an On-Board Oxygen Generation [OBOG] system
[AD-A063958] N79-24656
ONTARIO
Spatial characteristics of net radiation and its components for Ontario
N79-24562
OPERATOR PERFORMANCE
Operator performance and localized muscle fatigue in a simulated space vehicle control
N79-24653
OPERATORS [MATHEMATICS]
Optimality of spline algorithms
[AD-A065637] N79-24674
OPTICAL COMMUNICATION
The III - V heterostructure avalanche photodiode modules for fiber optic communication links in the 1.0 to 1.3 micrometer spectral range
[AD-A065537] N79-24272
GaAs electroabsorption avalanche photodiode waveguide detectors
[AD-A065986] N79-24824
OPTICAL COUPLING
Diversion and modulation of optical energy in graded index multimode fiber optics
[REPT-77-213/R] N79-24822
OPTICAL EQUIPMENT
Studies of photographic grain in a coherent optical system: Signal-dependence and its implications
[AD-A062528] N79-24325
OPTICAL FILTERS
A study of grating filters in thin-film optical waveguides
N79-24819
OPTICAL POLARIZATION
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions
N79-24782
OPTICAL PROPERTIES
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
Influence of thermal disorder on electronic properties of solids --- direct current conductivity and optical properties
N79-24872
OPTICAL PUMPING
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
OPTICAL RADAR
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221
The monopulse performance of an optical heterodyne detector with varying LO distributions
[AD-A066253] N79-24238
OPTICAL RESONANCE
High energy resonance transfer laser study
[AD-A065926] N79-24333
OPTICAL SCANNERS
Array scanning for image transmission
[AD-A065583] N79-24825
The scanning optical microscope
[OUEL-1243/78] N79-24829
OPTICAL TRACKING
Estimation of aircraft target motion using pattern recognition orientation measurements
[AD-A066195] N79-24682
New techniques for tracking sequences of digitized images
[AD-A066194] N79-24828
OPTICAL TRANSFER FUNCTION
The scanning optical microscope
[OUEL-1243/78] N79-24829
OPTICAL WAVEGUIDES
A study of grating filters in thin-film optical waveguides
N79-24819
New optical waveguide devices using periodic and chirped surface corrugations and optical waves in periodic layered structures
N79-24820
OPTICS
Optical pattern recognition for terminal guidance guidance
[AD-A062821] N79-23942
OPTIMAL CONTROL
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
Design of optimum compressed air energy storage systems
[CONF-7811101-1] N79-24508
Optimality of spline algorithms
[AD-A065637] N79-24674
Simulation study of self-tuning control laws
[OUEL-1201/77] N79-24683
An impulse control policy for a class of jump diffusion processes
[CSIR-T-WISK-55] N79-24698
The optimal tracking problem for nonstationary stochastic processes
[AD-A062689] N79-24700
OPTIMIZATION
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923
Substructuring methods for design sensitivity analysis and structural optimization
[AD-A065935] N79-23949
Optimization of the second order logarithmic machine economics problems by extended geometric programming
N79-24194
A class of structural optimization problems: Optimal archgrids
[ISD-236] N79-24388
Optimal beam layouts: Allowance for cost of shear
[ISD-237] N79-24389
Optimum plastic design of a variable-thickness orthotropic plate under in-plane loading
[OUEL-1237/78] N79-24398
Performance optimization of an MHD generator with physical constraints
[NASA-TM-79172] N79-24446
Finite element grid optimization with interactive computer graphics
N79-24692
Optimal detection in the presence of reverberation: Study and discussion of the stationary case
[CEPHAG-48/77] N79-24778
ORBIT CALCULATION
Development of analytical orbit propagation technique with drag
[NASA-CR-160176] N79-23992
SABAB: A program for calculating satellite ephemerides
[REPT-10-78] N79-23993
ORBIT PERTURBATION
Orbital theories of outer planet satellites
[NASA-CR-158667] N79-24925
ORBITAL ASSEMBLY
The array automated assembly task for the low cost solar array project, phase 2
[NASA-CR-158538] N79-24469
ORBITAL MECHANICS
Contingency study for the third international Sun-Earth Explorer [ISEE-3] satellite
[NASA-CR-159931] N79-23996
ORBITAL POSITION ESTIMATION
Preliminary results of the determination of the orientation of Interkosmos-17 AUOS
[NASA-TM-75613] N79-23994
ORGANIC COMPOUNDS
Identification of organic compounds in industrial effluent discharges
[PB-291900/9] N79-24111
Electrodeposition painting of metal substrates: Pinholing in surface films
[AD-A065968] N79-24160
Observations on the physico-chemical forms of cobalt, manganese, zinc, chromium and iron in sea water enriched or not with organic matter
[DRIC-TRANS-5370] N79-24625
Structure analyses of organic compounds using X-ray crystallographic techniques
N79-24851
ORGANIC MATERIALS
The combustion of organic polymeric materials. Ignition properties
[AD-A065967] N79-24162
ORGANIC PHOSPHORUS COMPOUNDS
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110
ORGANIC WASTES [FUEL CONVERSION]
Emergence of biotechnology
[TID-28983] N79-24626
ORGANISMS
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474
ORGANIZATIONS
Development and implementation of productivity measurement systems with emphasis on interorganization relationships
N79-24195
An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889
ORGANOMETALLIC COMPOUNDS
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds
N79-24076
Observations on the physico-chemical forms of cobalt, manganese, zinc, chromium and iron in sea water enriched or not with organic matter
[DRIC-TRANS-5370] N79-24625
ORLICZ SPACE
F-normed ideals of spaces of measurable functions
N79-24686
ORTHOSTATIC TOLERANCE
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
ORTHOTROPIC PLATES
Vibration and stability of beam reinforced polar orthotropic annular plates of uniform and variable thickness
N79-24363
Optimum plastic design of a variable-thickness orthotropic plate under in-plane loading
[OUEL-1237/78] N79-24398
OSCILLATIONS
An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982
Some observations on the random response of linear and nonlinear dynamical systems
[PB-290808/5] N79-24596
OSO
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932
OUTGASSING
Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071
OVERPRESSURE
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951
OXIDATION
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445
OXIDATION-REDUCTION REACTIONS
Spectroelectrochemical studies of fast reactions
N79-24082
Treatment of molybdenite ore using a 2 kW solar furnace
[LA-UR-79-6] N79-24478

OXIDE FILMS
Materials and techniques for spacecraft static charge control 2
N79-24034
OXIDIZERS
Inorganic halogen oxidizer research
[AD-A066149] N79-24177
OXYGEN
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system
N79-24075
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames
[AD-A066083] N79-24100
A proton activation study of oxygen diffusion in multicomponent glass-forming systems
N79-24152
Discharge processes in the oxygen plasma
[AD-A066196] N79-24841
OXYGEN PRODUCTION
Medical science in Siberia: Oxygen exchange in the Far North
[NASA-TM-75391] N79-24630
OXYGEN SUPPLY EQUIPMENT
US Navy development of an On-Board Oxygen Generation [OBOG] system
[AD-A063958] N79-24656
OZONE
Ozone/ultraviolet radiation monitoring
[PB-290594/1] N79-24539
Global distribution of ozone for various seasons
[NASA-TM-75435] N79-24564
A study of ozone concentrations in Southern Louisiana
[PB-291823/3] N79-24598
OZONOMETRY
Results of aerial and surface ozone measurements during the second half of 1977
[SONDERBEOB-36] N79-24591

P

P WAVES
Determination of earthquake source characteristics by computer simulation of teleseismic P-wave pulses
N79-24559
P-TYPE SEMICONDUCTORS
Investigation of low cost solar cells based on Cu2O
[PB-290940/6] N79-24516
PACIFIC NORTHWEST [US]
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
PACIFIC OCEAN
Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622
Investigations of sediment cores from the central Pacific SE of Hawaii from the VALDIVIA cruise 13/1
[BMFT-FB-M-77-08] N79-24624
PAIR PRODUCTION
The measurement of absolute pair production cross-sections at near-threshold energies and the development of a high resolution position spectrometer
N79-24783
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803
PALLADIUM
Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853
PALLADIUM COMPOUNDS
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses
N79-24856
PANELS
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951
PARABOLIC REFLECTORS
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
PARALLEL PROCESSING [COMPUTERS]
Parallel algorithms for multiple processor architectures
N79-24663
PARAMETERIZATION
A contemporary approach to the problem of determining physical parameters according to the results of measurements
[NASA-TM-75616] N79-24696
Optimization and application of microwave-excited discharges
N79-24830
PARKS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
PARTIAL PRESSURE
Flight test evaluation of an RAF high altitude partial pressure protective assembly
[NASA-TM-72864] N79-24654
PARTICLE ACCELERATORS
Magnetization effects in superconducting accelerator magnets
[BNL-24939] N79-24815
PARTICLE BEAMS
Potential mapping with charged-particle beams
N79-24038
PARTICLE COLLISIONS
Collision induced dissociation of diatomic molecules
[AD-A066191] N79-24798
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807
A configuration space study of low energy pion-nucleus scattering
N79-24811
PARTICLE DIFFUSION
Method for using acoustic sounder categories to determine atmospheric stability
[DP-MS-78-49] N79-24618
PARTICLE ENERGY
A rocket-borne pulse-height analyzer for energetic particle measurements
[NASA-CR-158645] N79-24570
PARTICLE FLUX DENSITY
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792
PARTICLE INTERACTIONS
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Interactions between spacecraft and the charged-particle environment
N79-24021
Life games: Statistical, deterministic and computer approaches in physics
N79-24721
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803
PARTICLE MOTION
Mechanisms of particle transport and electro-kinetic phenomena in a cross flow/electrofilter
N79-24088
PARTICLE PRODUCTION
Multi-Regge factorization in inclusive two-particle production
[ILL-(TH)-79-14] N79-24793
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807
PARTICLE SIZE DISTRIBUTION
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
Seasonal variations in ultraviolet single scattering phase functions
[AD-A066160] N79-24585
PARTICLE SPIN
Unitarity constraints on meson-nucleon helicity-flip amplitudes and slope of the diffraction peak
[PM/78/7] N79-24802
Neutrinos and long-range weak forces in cosmology
N79-24882
PARTICLE TRAJECTORIES
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029
PARTICULATE SAMPLING
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
PASSENGERS
Human factors engineering research for Cabin Taxi [CAT]
[MBB-UFE-1355-O] N79-24901
PATTERN RECOGNITION
Optical pattern recognition for terminal guidance guidance
[AD-A062821] N79-23942
Estimation of aircraft target motion using pattern recognition orientation measurements
[AD-A066195] N79-24682
Learning with imperfectly labeled patterns
[NASA-CR-160183] N79-24697
PAYLOADS
Description of the Space Test Program P78-2 spacecraft and payloads
N79-24002
Design, development, and flight of a spacecraft charging sounding rocket payload
N79-24009
PDP 11/40 COMPUTER
Interlisp-11
[AD-A066142] N79-24675
PEBBLE BED REACTORS
Engineering implications following the attachment of catalytically active transition metal complexes onto solid supports the leaky catalyst
N79-24080
PERFORMANCE
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345
PERFORMANCE PREDICTION
Effect of high load on the fatigue behavior of unnotched graphite/epoxy laminates
[AD-A065631] N79-24069
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877
PERFORMANCE TESTS
Performance testing of the McDonnell Douglas fresnel lens solar collector
[SAND-78-0625] N79-24512
PERMEABILITY
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764
PERTURBATION
The effect of disturbance on a wing
N79-23893
Asymptotic stability of a class of nonlinear singularly perturbed systems
[AD-A062957] N79-24701
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928
PERTURBATION THEORY
Lie transforms and their use in Hamiltonian perturbation theory
[DOE/ET-0074] N79-24727
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas
N79-24730
Propagation of ion acoustic cnoidal wave
[IPPJ-367] N79-24837
Orbital theories of outer planet satellites
[NASA-CR-158667] N79-24925
PETROGRAPHY
Petrographic and petrological studies of lunar rocks
[NASA-CR-159921] N79-24929
PETROLOGY
Petrographic and petrological studies of lunar rocks
[NASA-CR-159921] N79-24929
PHASE COHERENCE
Composite oscillator systems for meeting user needs for time and frequency
N79-24733
PHASE DIAGRAMS
Microstructural study of V2D by X-ray measurements
N79-24854
PHASE SHIFT
Comparative study of phase curves obtained by different methods for estimating cross spectral density. Geographic applications: Measure of phase shift and delay of PC 1 signals
[CEPHAG-4/78] N79-24243
PHASE TRANSFORMATIONS
Investigation of medium and high temperature phase change materials
[NASA-TM-75398] N79-24097
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition
N79-24788
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855
A test of curvature elasticity above the nematic-smectic A phase transition
N79-24859
PHASED ARRAYS
Phase conjugation method and apparatus for an active retrodirective antenna array
[NASA-CASE-NPO-13641-1] N79-24210
PHENOLIC RESINS
Rapid method for determining free formaldehyde in phenol-formaldehyde resins
[BLL-RTS-11594] N79-24144
PHENOLOGY
Reports from the German Meteorological Service. Volume 18, No. 144. Contributions to the phenology of Europe. Part 3: Results from international phenological gardens [regional and annual differences] 1966-1975
[ISBN-3-88148-157-5] N79-24606
PHENOLS
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521

PHENYLS
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls
N79-24085
The reaction of phenyllithium with poly-[dichlorophosphazene]
[AD-A066183] N79-24165
PHILIPPINES
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins
N79-24560
PHOSPHORUS
Multistep energy migration and radiationless relaxation processes in phosphor and laser crystals
[AD-A066086] N79-24334
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536
PHOSPHORUS COMPOUNDS
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses
N79-24856
PHOTOCATHODES
Basic studies of high performance multialkali photocathodes
[AD-A066064] N79-24273
PHOTOCHEMICAL REACTIONS
Modeling of simulated photochemical smog with kinetic mechanisms, Volume 1
[PB-290507/3] N79-24531
Modelling of simulated photochemical smog with kinetic mechanisms. Volume 2: Appendix
[PB-290508/1] N79-24532
PHOTOCONDUCTORS
Gallium-doped germanium, evaluation of photoconductors, part 1
[NASA-CR-152222] N79-24875
PHOTODIODES
The III - V heterostructure avalanche photodiode modules for fiber optic communication links in the 1.0 to 1.3 micrometer spectral range
[AD-A065537] N79-24272
PHOTODISSOCIATION
Calculations on isotope separation by laser induced photodissociation of polyatomic molecules
[COO-4294-2] N79-24800
PHOTOELASTIC ANALYSIS
Fundamentals of ordinary ion exchange
N79-24094
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
PHOTOELECTRIC EMISSION
Diffusion limit for the transport of quasifree electrons in liquids
[AD-A065679] N79-24795
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin
N79-24868
PHOTOELECTRONS
The photoelectron flux in the earth's ionosphere at energies in the vicinity of photoionization peaks
[AD-A062310] N79-24580
PHOTOGRAPHIC FILM
A cookbook for dichromated gelatin holograms
[AD-A065642] N79-24324
PHOTOGRAPHIC PLATES
A cookbook for dichromated gelatin holograms
[AD-A065642] N79-24324
PHOTOGRAPHIC PROCESSING
Solar project description: Iris Images, Incorporated, film laboratory, Mill Valley, California
[SOLAR/2005-78/50] N79-24486
PHOTOGRAPHY
Studies of photographic grain in a coherent optical system: Signal-dependence and its implications
[AD-A062528] N79-24325
PHOTOLITHOGRAPHY
Photolithographic techniques for Surface Acoustic Wave [SAW] devices. Volume 2: Technical and operational parts 1 and 2
[AD-A065566] N79-24774
PHOTOLYSIS
Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330
PHOTOMETRY
A photometric and kinematic study of the barred spiral galaxy NGC 253
N79-24923
PHOTONS
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803
PHOTOOXIDATION
Laboratory investigation of the photooxidation and catalytic oxidation of SO2
[PB-290859/8] N79-24533
PHOTOSPHERE
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932
PHOTOVOLTAIC CELLS
Description of photovoltaic village power systems in the United States and Africa
[NASA-TM-79149] N79-24443
Application and system design study for cost-effective solar photovoltaic systems at Federal installations
[HCP/CS-0306] N79-24500
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511
Cuprous oxide photovoltaic cells --- fabricating schottky barrier devices
[PB-290529/7] N79-24514
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877
PHOTOVOLTAIC CONVERSION
Description of photovoltaic village power systems in the United States and Africa
[NASA-TM-79149] N79-24443
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877
PHYSICAL EXERCISE
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
PHYSICAL PROPERTIES
Some physical and chemical properties of sodium-aluminate solutions
[BLL-RTS-11347] N79-24074
Physical properties of sediments from the continental margin of western Africa
N79-24555
PHYSIOLOGICAL EFFECTS
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
PHYSIOLOGICAL RESPONSES
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
PHYSIOLOGY
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643
The application of sensitivity analysis to models of large scale physiological systems
[NASA-CR-160228] N79-24645
PIEDMONTS
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816
PIEZOELECTRIC GAGES
Contactless measurement of carrier generation rate in semiconductors
[AD-A062880] N79-24876
PIEZOELECTRIC TRANSDUCERS
Broadband zinc oxide transducer for integrated optics
[AD-A062851] N79-24827
PIEZOELECTRICITY
Quartz crystal and superconductive resonators and oscillators
N79-24737
PILOT PLANTS
Solvent Refined Coal [SRC] process: Operation of solvent refined coal pilot plant
[FE-2270-34] N79-24181
In situ coal gasification modeling
[UCRL-82269] N79-24479
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation
N79-24896
PILOT TRAINING
Contributions of platform motion to simulator training effectiveness. Study 2: Aerobatics
[AD-A064305] N79-23985
Computer image generation: Improved edge utilization study
[AD-A065640] N79-24673
PIONS
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations
N79-24810
A configuration space study of low energy pion-nucleus scattering
N79-24811
PIPELINES
Pipeline gas from coal-hydrogenation: IGT hydrogasification process, project 9000
[FE-2434-29] N79-24184
PITCH [INCLINATION]
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control
N79-23895
An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982
PLANAR STRUCTURES
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923
PLANE WAVES
An asymptotic result for the scattering of a plane wave by a smooth convex cylinder
[AD-A065588] N79-24229
PLANETARY ATMOSPHERES
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928
PLANETARY ORBITS
Mercury orbiter transport study
[NASA-CR-158658] N79-23987
PLANETOLOGY
Advanced planetary studies
[NASA-CR-158657] N79-24915
PLANKTON
A mixed layer model of wind and density driven mixing during a phytoplankton bloom
[DM-24] N79-24619
PLANTS [BOTANY]
Hydrocarbons and energy from plants
[LBL-8596] N79-24507
PLASMA ACCELERATORS
Mechanisms of magnetoplasmadynamic arcjet acceleration processes
[AD-A065617] N79-24060
PLASMA COMPOSITION
Study of similarity flows of two component laser produced plasmas
N79-24844
PLASMA CONTROL
ELMO Bumpy Torus
[ORNL/TM-6743] N79-24842
Influence of globalmagnetic perturbations on plasma behavior in Elmo Bumpy Torus
[ORNL/TM-6704] N79-24843
PLASMA DIAGNOSTICS
Research in gas lasers
[AD-A065743] N79-24331
PLASMA DYNAMICS
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas
N79-24730
PLASMA HEATING
Resonant modes of a toroidal plasma in the large major radius approximation --- radiation heating
[CTH-IEFT/PP-1977-13] N79-24846
PLASMA INTERACTIONS
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Analytical study of the time dependent spacecraft-plasma interaction
N79-24017
Plasma Interaction Experiment [PIX] flight results
N79-24022
Effect of parasitic plasma currents on solar-array power output
N79-24025
Magnetic shielding of large high-power-satellite solar arrays using internal currents
N79-24026
Environmental interaction implications for large space systems
N79-24027
Space environmental effects and the solar power satellite
N79-24028
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029
PLASMA JETS
Optimization and application of microwave-excited discharges
N79-24830
PLASMA OSCILLATIONS
Fluctuations in active molecular plasmas
[CTH-IEFT/PP-1978-1] N79-24849
PLASMA PHYSICS
Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832
Discharge processes in the oxygen plasma
[AD-A066196] N79-24841

Coupled nonlinear Schroedinger equations including growth and damping
[CTH-IEFT/PP-1977-14] N79-24847
Research activities of the Institute of Extraterrestrial Physics --- plasma and particle phenomena
[MPI-PAE-EXTRATERR-141] N79-24936
Tokamak physics: The 70th birthday of L. A. Artsimovich [25 February 1909 to 1 March 1973]
N79-24944

PLASMA PROBES
Probe measurement technique in a Tokamak
[BLL-CTO/1563-[9091.9F]] N79-24831
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838

PLASMA SHEATHS
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024

PLASMA-ELECTROMAGNETIC INTERACTION
NASCAP modelling of high-voltage power system interactions with space charged-particle environments
[NASA-TM-79146] N79-24000

PLASMAS [PHYSICS]
Modeling of the geosynchronous plasma environment
N79-24003
Average plasma environment at geosynchronous orbit
N79-24004
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source
N79-24006
Operations of the ATS-6 ion engine
N79-24007
Optimization and application of microwave-excited discharges
N79-24830
Anomalous plasma transport due to electron temperature gradient instability
[IPPJ-369] N79-24833
Collisionless tearing instabilities
[IPPJ-370] N79-24834
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839
Low-energy particle experiment
[AD-A066150] N79-24840

PLASTIC COATINGS
An exploratory investigation of the effect of plastic coating on the profile drag of a practical-metal-construction sailplane airfoil
N79-23891

PLASTIC DEFORMATION
Elastic-plastic torsion of prismatic bars with polygonal cross section
[ETEC-TRANS-1] N79-24384

PLASTIC PROPERTIES
Recent finite element studies in plasticity and fracture mechanics
[COO-3084-62] N79-24383

PLASTICS
Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167

PLATE THEORY
Simple formulae for calculating the vibrational frequencies of plates, shells and membranes
[ARL-STRUC-REPT-371] N79-24374

PLATING
Nickel coatings achieved without the use of electric current
[BLL-RTS-11605] N79-24113

PLATINUM
Activity and selectivity of platinum single crystal surfaces and supported platinum catalysts for hydrocarbon reactions at atmospheric pressure
N79-24086
Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853

PLATINUM COMPOUNDS
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses
N79-24856

PLUG NOZZLES
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966

PLUMES
Kinetic reaction coefficients in rocket exhaust plumes
[AD-A065646] N79-24059

PNEUMATIC CONTROL
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345

POINT SOURCES
Localized sources of gamma rays of 3 to 25 MeV
N79-24933

POISSON DENSITY FUNCTIONS
Generation of non-homogeneous poisson processes by thinning: Programming considerations and comparison with competing algorithms
[AD-A066345] N79-24719

POLAND
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
Polish Interkosmos participation described
N79-23991
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938

POLAR ORBITS
Modern methods for the determination of polar motion and UT1
N79-24754

POLARIZATION CHARACTERISTICS
A semiempirical approach for resonance Raman intensities
N79-24078

POLICIES
US civilian space policy
[GPO-42-110] N79-23988

POLLUTION CONTROL
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534
Emission density zoning guidebook. A technical guide to maintaining air quality standards through land-use-based emission limits
[PB-290657/6] N79-24579
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906

POLLUTION MONITORING
Identification of organic compounds in industrial effluent discharges
[PB-291900/9] N79-24111
Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
Ozone/ultraviolet radiation monitoring
[PB-290594/1] N79-24539
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609

POLYAMIDE RESINS
Biodegradable polymer: Synthesis and characterization of methyl- and hydroxyl-containing polyamides, polyfumaramides, and polyenamines
N79-24147

POLYATOMIC MOLECULES
Calculations on isotope separation by laser induced photodissociation of polyatomic molecules
[COO-4294-2] N79-24800

POLYBUTADIENE
The high temperature aqueous modification of polybutadiene and a styrene crosslinked unsaturated polyester
N79-24145

POLYCARBONATES
Effect of annealing below the glass transition temperature on sorption and transport of carbon dioxide in polycarbonate
N79-24148
A study of miscibility in blends of polycarbonate with polyesters
N79-24150

POLYESTERS
The high temperature aqueous modification of polybutadiene and a styrene crosslinked unsaturated polyester
N79-24145
A study of miscibility in blends of polycarbonate with polyesters
N79-24150

POLYETHYLENES
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908

POLYHEDRONS
Analyzing the solution of problems involving three-dimensional geometric figures: An exploratory study
N79-24687

POLYIMIDE RESINS
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061

POLYMER MATRIX COMPOSITE MATERIALS
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066

POLYMERIC FILMS
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110

POLYMERIZATION
NMR studies of synthetic polypeptide structures
N79-24146
Polymerization of sicica in aqueous solutions
N79-24149
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures
[NASA-CASE-ARC-11241-1] N79-24153
The reaction of phenyllithium with poly-[dichlorophosphazene]
[AD-A066183] N79-24165
Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168

POLYMERS
Selective transport of sulfur-dioxide through polymer membranes
N79-24089
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
The combustion of organic polymeric materials. Ignition properties
[AD-A065967] N79-24162
Evaluation of flow properties of dilute aqueous polymer solutions for enhanced oil recovery applications
N79-24408

POLYNOMIALS
Spectral characteristics of piecewise polynomial representation of digital signals
N79-24659
Piecewise polynomials for the probability of clustering on the unit interval
N79-24714

POLYPEPTIDES
NMR studies of synthetic polypeptide structures
N79-24146

POLYPHENYLS
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin
N79-24868

POLYTOPES
Representing simple polytopes by order structures
N79-24688

POPULATIONS
A Gaussian approximation to the distribution of sample variance for nonnormal populations
[AD-A065738] N79-24699

PORPHYRINS
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin
N79-24868

PORTS [OPENINGS]
The 1.11 new considerations on the development of vortex ports --- for small capacity direct injection engine
[BLL-RTS-11759] N79-24347

POSITION [LOCATION]
High surface area amorphous silica-alumina cracking catalysts with controlled site spacings
[CSIR-CENG-232] N79-24068

POSITRONS
The measurement of absolute pair production cross-sections at near-threshold energies and the development of a high resolution position spectrometer
N79-24783

POTENTIAL FIELDS
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments
N79-24787

POTENTIAL THEORY
An implicit algorithm for the conservative, transonic full-potential equation with effective rotated differencing
[NASA-TM-78570] N79-23909
The calculation of spacecraft potential: Comparison between theory and observation
N79-24019
Spacecraft potential control on ISEE-1
N79-24020
Excimer potential curves
[AD-A066043] N79-24332

POWDER METALLURGY
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128

POWER CONDITIONING
Effect of parasitic plasma currents on solar-array power output
N79-24025

Module failure isolation circuit for paralleled inverters a-- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254

POWER MODULES [STS]
A programmable power processor for a 25-cW power module
[NASA-TM-78215] N79-24441
Heat source component development program
[BMI-X-699] N79-24799

POWER PLANTS
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474

POWER SPECTRA
Prediction of the angular response power spectral density of aircraft structures
[AD-A066141] N79-23956
Spectral analysis by means of autoregressive filter
[CEPHAG-41/77] N79-24241
Study of the influence of negative ions on the incoherent scattering spectra --- mesosphere
[CEPHAG-45/77] N79-24242

POWER SUPPLIES
Power industry application of MHD technology
N79-24949

PRECIPITATION [CHEMISTRY]
Studies in the theory and practices of foam flotation techniques
N79-24077

PRECIPITATION [METEOROLOGY]
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911

PRECISION
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731
Precise terrestrial time: A means for improved ballistic missile guidance analysis
N79-24736
A review of the US Navy's Precise Time and Time Interval [PTTI] program
N79-24743

PREDICTION ANALYSIS TECHNIQUES
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770

PREPOLYMERS
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164

PRESSURE
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087
Stability and amplification of shock waves
[AD-A066108] N79-24305

PRESSURE DISTRIBUTION
Length and bursting of separation bubbles: A physical interpretation --- of pressure distribution
N79-23898
Further developments in simple total energy sensors
N79-23900
Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963

PRESSURE EFFECTS
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969

PRESSURE MEASUREMENTS
High-temperature microphone system --- for measuring pressure fluctuations in gases at high temperature
[NASA-CASE-LAR-12375-1] N79-24203

PRESSURE OSCILLATIONS
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968

PRESSURE SUITS
Flight test evaluation of an RAF high altitude partial pressure protective assembly
[NASA-TM-72864] N79-24654

PRESSURE VESSELS
Improved ultrasonic nondestructive testing of pressure vessels
[NUREG-CR-0581] N79-24361
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
Critical experiments, measurements and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[PB-291190/7] N79-24405

PRESSURIZING
Metallic xenon
N79-24118

PRIMARY BATTERIES
The potential recovery of porous graphite fluoride electrodes after termination of the load current
[AD-A065544] N79-24264

PRIMERS [COATINGS]
Evaluation of new bonding systems for depot-level maintenance of aircraft honeycomb panels
[AD-A066117] N79-24161

PRINTED CIRCUITS
Deleterious effect of MIL-F-14256, type RA fluxes on printed wiring boards
[AD-A066129] N79-24274

PRISMATIC BARS
Elastic-plastic torsion of prismatic bars with polygonal cross section
[ETEC-TRANS-1] N79-24384

PROBABILITY THEORY
Tropical cyclone strike probability forecasting
[AD-A065545] N79-24611
Piecewise polynomials for the probability of clustering on the unit interval
N79-24714
Inference and decision making based on interval-valued probability
N79-24717

PROBLEM SOLVING
Analyzing the solution of problems involving three-dimensional geometric figures: An exploratory study
N79-24687
Some uniqueness problems in nonlinear L sub p-approximation
N79-24693

PROCESS CONTROL [INDUSTRY]
Systems studies of coal conversion processes using a reference simulator
[FE-2275-8] N79-24187

PRODUCT DEVELOPMENT
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
Effects of impurities and processing on silicon solar cells, phase 3
[NASA-CR-158569] N79-24472

PRODUCTION ENGINEERING
Reliability trade-offs for unit production cost
[AD-A065643] N79-24360
Development of a model and computer code to describe solar grade silicon production processes
[NASA-CR-158679] N79-24448
Development of high efficiency [14%] solar cell array module
[NASA-CR-158672] N79-24454
Automated solar panel assembly line. LSA task; production processes and equipment
[NASA-CR-158671] N79-24455
Photolithographic techniques for Surface Acoustic Wave [SAW] devices. Volume 2: Technical and operational parts 1 and 2
[AD-A065566] N79-24774

PRODUCTIVITY
Development and implementation of productivity measurement systems with emphasis on interorganization relationships
N79-24195

PROGRAM TREND LINE ANALYSIS
A review of the icing situation from the standpoint of general aviation
N79-23918

PROGRAM VERIFICATION [COMPUTERS]
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program --- for the space shuttle orbiter
[NASA-CR-160178] N79-24672

PROGRAMMED INSTRUCTION
LHC-PILOT, user guide
[PB-291985/0] N79-24676

PROGRAMMING LANGUAGES
LHC-PILOT, user guide
[PB-291985/0] N79-24676
LHC-PILOT, system guide
[PB-291986/8] N79-24677

PROJECT MANAGEMENT
Solar project description. Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/50] N79-24499
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907

PROJECT PLANNING
Five year plan for space test program
[AD-A065866] N79-23989
Solar project cost report: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/60] N79-24482
Solar project description. Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/50] N79-24496

PROPELLANT ACTUATED INSTRUMENTS
Bistable [latching] solenoid actuated propellant isolation valve
[NASA-CR-158673] N79-24352

PROPELLERS
Design of propellers for motorsoarers
N79-23903

PROPULSION
An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889

PROPYL COMPOUNDS
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164

PROSTHETIC DEVICES
Compact artificial hand
[NASA-CASE-NPO-13906-1] N79-24652

PROTECTIVE CLOTHING
Flight test evaluation of an RAF high altitude partial pressure protective assembly
[NASA-TM-72864] N79-24654

PROTON SCATTERING
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations
N79-24810

PROTONS
A proton activation study of oxygen diffusion in multicomponent glass-forming systems
N79-24152
Distribution of positive ion species above a diffuse midnight aurora
N79-24550

PSYCHOLOGICAL EFFECTS
Stress and fatigue in the driving environment --- physiological and psychological effects of heat and noise experienced inside automobiles
N79-24629

PUBLIC HEALTH
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769

PUBLIC LAW
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907

PULSARS
Pulsar timing results from Arecibo Observatory
N79-24917

PULSE AMPLITUDE
A rocket-borne pulse-height analyzer for energetic particle measurements
[NASA-CR-158645] N79-24570

PULSE COMMUNICATION
Overview of timing/synchronization for digital communications
N79-24746
Survey of timing/synchronization of operating wideband digital communications networks
N79-24747
An Evaluation of optional timing/synchronization features to support selection of an optimum design for the DCS digital communication network
N79-24748
Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network
N79-24749

PULSE DURATION
Pulsar timing results from Arecibo Observatory
N79-24917

PULSED LASERS
Nd:YAG development for spaceborne laser ranging system
[NASA-CR-159932] N79-24329
Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330
Interpretation of enhanced laser-plasma backscattering due to prepulse radiation
N79-24340

PYRIDINES
The effects of finite size on the critical behavior of fluid films
N79-24288

PYROLYSIS
Hydropyrolysis of coal derived liquids and related model compounds
N79-24171
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468

PYROTECHNICS
Sensitivity of burning rate to initial temperature for a binary magnesium-sodium nitrate mix
[AD-A066119] N79-24175

Q

QUADRATIC PROGRAMMING
Optimization of the second order logarithmic machine economics problems by extended geometric programming
N79-24194

QUADRUPOLES
Electronics for a rocket borne quadrupole cluster ion mass filter
[AD-A066289] N79-24587
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap --- interaction of helium ions with cesium atoms
N79-24784

QUALITATIVE ANALYSIS
Fluid sample collection and distribution system --- qualitative analysis of aqueous samples from several points
[NASA-CASE-MSC-16841-1] N79-24285

QUANTUM CHEMISTRY
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames
[AD-A066083] N79-24100

QUANTUM ELECTRODYNAMICS
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803

QUANTUM MECHANICS
On the quantum mechanical theory of ball lightning
[BLL-CTO/1560-[9091.9F]] N79-24563

QUANTUM THEORY
On the quantum mechanical theory of ball lightning
[BLL-CTO/1560-[9091.9F]] N79-24563
Time delay in quantum scattering
N79-24885

QUARTZ CRYSTALS
Quartz crystal and superconductive resonators and oscillators
N79-24737

QUINOXALINES
Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167

R

RADAR BEACONS
Discrete address beacon system. A bibliography with abstracts
[NTIS/PS-79/0244/8] N79-23945

RADAR IMAGERY
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-[9022.549]]
N79-24602

RADAR SCANNING
Multiple antenna beam formation techniques for synthetic aperture radar
N79-24206

RADAR SIGNATURES
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577

RADAR TARGETS
Considerations concerning detection of non-cooperative illuminated targets
[REPT-2-78] N79-24245

RADAR TRACKING
SEATRACKS: A 35 GHz monopulse tracking radar
[AD-A065933] N79-24219
Considerations concerning detection of non-cooperative illuminated targets
[REPT-2-78] N79-24245

RADIATION
A feasibility study of the use of radiant energy for fog dispersal
[AD-A063143] N79-24613

RADIATION ABSORPTION
Tuned diode laser measurements of atmospheric absorption profiles in the 4.5 micrometers to 5.0 micrometers region
[AD-A066159] N79-24584

RADIATION CHEMISTRY
Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing
N79-24858

RADIATION COUNTERS
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839

RADIATION DAMAGE
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055

RADIATION DISTRIBUTION
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934

RADIATION DOSAGE
Atmospheric neutrons
[NASA-CR-3126] N79-24631

RADIATION EFFECTS
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 1: Executive summary
[NASA-TM-80354] N79-24435
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 2: Detailed assessment
[NASA-TM-80355] N79-24436
Studies on the microwave-induced auditory effect
[PB-290598/2] N79-24648

RADIATION HAZARDS
Cytochemical study related to laser application
[AD-A065671] N79-24335

RADIATION MEASUREMENT
Spatial characteristics of net radiation and its components for Ontario
N79-24562

RADIATION SHIELDING
TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053

RADIATIVE TRANSFER
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928

RADIO ASTRONOMY
Pulsar timing results from Arecibo Observatory
N79-24917

RADIO COMMUNICATION
Spectrum efficiency for multiple independent spread-spectrum land mobile radio systems
[PB-291539/5] N79-24248

RADIO DIRECTION FINDERS
Standard engineering installation package. Terminal VHF Omnidirectional Range [TVOR] system an/FRN-4i
[AD-A065932] N79-23941

RADIO FREQUENCIES
CFA design improvement program. Volume 1: Instrumented CFA studies
[AD-A065735] N79-24262
CFA design improvement program. Volume 2: Computer modeling studies
[AD-A065736] N79-24263

RADIO FREQUENCY HEATING
Resonant modes of a toroidal plasma in the large major radius approximation --- radiation heating
[CTH-IEFT/PP-1977-13] N79-24846

RADIO NAVIGATION
PTTI applications to deep space navigation
N79-24759

RADIO SIGNALS
Comparison of signal scintillation models
[AD-A066102] N79-24227

RADIO TRANSMISSION
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247

RADIO WAVES
Comparative equatorial scintillation morphology: American and pacific sectors
[AD-A066094] N79-24224
An integral-equation approach to ELF propagation in a non-stratified earth-ionosphere waveguide
[AD-A066097] N79-24230
Investigation of methods for converting the FCC ground wave field intensity curves to the metric system
[PB-290930/7] N79-24250

RADIOACTIVE ISOTOPES
Heat source component development program
[BMI-X-699] N79-24799
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program --- concerning the use of radioisotopic power systems
[LA-7694-PR] N79-24801

RADIOACTIVE WASTES
A radiological environs study at a fuel fabrication facility
[PB-291928/0] N79-24530
Radioactive waste disposal: A comparison of alternative nuclear fuel cycles
N79-24812
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816

RAIN
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608

RAMAN LASERS
Proposed implementation of laser Raman scattering spectroscopy for analysis of hydrogen isotopes
[MLM-2583] N79-24107

RAMAN SPECTRA
A semiempirical approach for resonance Raman intensities
N79-24078

RANDOM LOADS
A method for deriving statistical parameters for design against random stresses resulting from working operations
[LFB-FB-135] N79-24402

RANDOM PROCESSES
Comparative study of phase curves obtained by different methods for estimating cross spectral density. Geographic applications: Measure of phase shift and delay of PC 1 signals
[CEPHAG-4/78] N79-24243
L sub p-intensities of random measures
[CTH-MATH-1978-2] N79-24704
Optimal detection in the presence of reverberation: Study and discussion of the stationary case
[CEPHAG-48/77] N79-24778

RANDOM VARIABLES
Internal and external models of variable parameter filters
[CEPHAG-44/77] N79-24777

RANGE [EXTREMES]
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247

RANGEFINDING
Nd:YAG development for spaceborne laser ranging system
[NASA-CR-159932] N79-24329

RARE EARTH ALLOYS
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764

RARE GASES
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781

RATIONAL FUNCTIONS
On rational approximations of semigroups
[CTH-MATH-1978-3] N79-24729

RATIOS
Weak convergence of progressively censored likelihood ratio processes
N79-24712

RAY TRACING
An analysis of the mutual coupling between antennas on a smooth convex surface
[AD-A065591] N79-24211
Studies in ionospheric ray tracing
[CSIR-R-MAG-5/17] N79-24573

RAYLEIGH SCATTERING
Seasonal variations in ultraviolet single scattering phase functions
[AD-A066160] N79-24585

REACTION KINETICS
Kinetic reaction coefficients in rocket exhaust plumes
[AD-A065646] N79-24059
Spectroelectrochemical studies of fast reactions
N79-24082
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls
N79-24085
Analysis of coke combustion during in-situ oil recovery
N79-24095
On the correlation of the kinetics of electron transfer processes with the change in reaction free energy. Application to electron-exchange initiated chemiluminescence reactions
[AD-A066342] N79-24105
Experimental study of the kinetics of dry, forward combustion
[BETC-1820-1] N79-24106
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330
Research in gas lasers
[AD-A065743] N79-24331
Theoretical modeling of molecular and electron kinetic processes. Volume 1: Theoretical formulation of analysis and description of computer program
[AD-A066155] N79-24337
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338
Modeling of simulated photochemical smog with kinetic mechanisms, Volume 1
[PB-290507/3] N79-24531
Modelling of simulated photochemical smog with kinetic mechanisms. Volume 2: Appendix
[PB-290508/1] N79-24532
Structural and dynamic considerations in molecular collision theory
[AD-A065531] N79-24794

On tha reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl
[MPIS-19/1977] N79-24805

REACTOR MATERIALS
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
Corrosion of stainess steel, volume 2. A bibliography with abstracts
[NTIS/PS-79/0208/3] N79-24143
Critical experiments, measurements and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[PB-291190/7] N79-24405

RECOILINGS
Hydrogen depth profiling using elastic recoil detection --- using helium ions
[SAND-79-0210C] N79-24878

RECOVERY VEHICLES
Flame nosetip recovery vehicle flight test series
[AD-A066217] N79-24058

RECRYSTALLIZATION
Development of preferred orientation in uniaxially deformed olivine aggregates
N79-24554

RECURSIVE FUNCTIONS
Data compression: Methods and complexity issues
N79-24662

RECYCLING
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives --- economic analysis
N79-24813

REDUCED GRAVITY
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295

REDUCTION [CHEMISTRY]
Spectroscopic investigations of metal cation reduction at glass surfaces
N79-24079
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445

REENTRY EFFECTS
Heat source component development program
[BMI-X-699] N79-24799

REENTRY SHIELDING
Fibrous refractory composite insulation --- shielding reusable spacecraft
[NASA-CASE-ARC-11169-1] N79-24062

REENTRY VEHICLES
Hardened RV development program. Phase 4: Vehicle recovery technology wind tunnel tests
[AD-A066095] N79-23930

REFINING
Solvent Refined Coal [SRC] process: Operation of solvent refined coal pilot plant
[FE-2270-34] N79-24181
US refining capacity: How much is enough
[PB-291437/2] N79-24192

REFLECTION
Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821

REFRACTIVITY
The effects of finite size on the critical behavior of fluid films
N79-24288

REFRACTORY MATERIALS
Fibrous refractory composite insulation --- shielding reusable spacecraft
[NASA-CASE-ARC-11169-1] N79-24062
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
Development and evaluation of die and container materials. Low cost silicon solar array project
[NASA-CR-158670] N79-24351

REFRIGERATORS
The design, construction and calibration of a research cold room complex
[CSIR-ME-1577] N79-23983

REGGE POLES
Multi-Regge factorization in inclusive two-particle production
[ILL-[TH]-79-14] N79-24793

REGIONAL PLANNING
A systems procedure for land use and water quality planning in a rural watershed
N79-24406
Self-starting manual for direct use applications of geothermal resources
[PB-290872/1] N79-24423
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891

REGRESSION ANALYSIS
Linear least squares regression algorithm: NMGS2
[PB-290475/3] N79-24678
Non-linear model fitting and function minimisation package
[OUEL-1194/77] N79-24706
A modified Robbins-Monro procedure and its applications
N79-24716

REINFORCING FIBERS
Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071

RELATIVISTIC PARTICLES
Interactions of relativistic charged particle beams
[AD-A066045] N79-24814

RELATIVISTIC PLASMAS
Numerical simulation of spherically symmetric matter in relativity
N79-24883

RELATIVISTIC THEORY
Down to earth relativity
N79-24753

RELATIVITY
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations
N79-24886

RELAXATION [MECHANICS]
Multistep energy migration and radiationless relaxation processes in phosphor and laser crystals
[AD-A066086] N79-24334

RELAXATION TIME
Inelastic resistance calculations with time dependent thermal and mechanical stress
[ISD-238] N79-24390
Relaxation of excited neon atoms in their parent gas
N79-24786
Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum
N79-24862
Measurement of the thermal emission of tungsten and analysis of electron relaxation effects
N79-24866

RELIABILITY ANALYSIS
Reliability trade-offs for unit production cost
[AD-A065643] N79-24360
Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438

REMOTE CONTROL
Proximity-vision system for protoflight manipulator arm
[NASA-CR-158652] N79-24658

REMOTE SENSORS
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418
Microwave remote sensing laboratory design
[NASA-CR-159015] N79-24419
Instrumentation and data processing used in Earth Resources Technology Satellites [ERTS], volume 2. A bibliography with abstracts
[NTIS/PS-79/0206/7] N79-24430
Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582
A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892

REPUBLIC OF SOUTH AFRICA
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608

RESEARCH
Basic research on ceramic materials for energy storage and conversion system
[COO-2564-4] N79-24506

RESEARCH AND DEVELOPMENT
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202
Microwave remote sensing laboratory design
[NASA-CR-159015] N79-24419
ATMOS Spacelab 1 science investigation
[NASA-TM-80465] N79-24568
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program --- concerning the use of radioisotopic power systems
[LA-7694-PR] N79-24801

RESEARCH FACILITIES
Space research in Denmark
N79-24937

RESEARCH MANAGEMENT
Inorganic halogen oxidizer research
[AD-A066149] N79-24177
Energy Materials Coordinating Committee [EMACC]
[DOE/US-002] N79-24490
Office of Research and Development program guide, fiscal year 1979
[PB-292003/1] N79-24912

RESEARCH PROJECTS
Swedish solar energy projects, 1978
[SIB-D-13-1978] N79-24502
Energy/Environment 3: Proceedings of the 3rd National Conference on the Interagency R and D Program
[PB-290558/6] N79-24535
Wind engineering research digest, volume 3, 1978 --- a bibliography of ongoing research projects
[PB-290694/9] N79-24621
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
Research needs for community water management
[PB-291938/9] N79-24905
Advanced planetary studies
[NASA-CR-158657] N79-24915

RESERVOIRS
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428

RESIDENTIAL AREAS
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910

RESIDUAL STRESS
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125
Predicting stress corrosion cracking in welded steel based on residual stress measurements
[BDX-613-2099-REV] N79-24131
Partially balanced residual effects designs
N79-24709

RESONANT VIBRATION
Measurement of resonance vibrations of turbine blades with the Elura device
[AD-A066122] N79-23976

RESONATORS
Quartz crystal and superconductive resonators and oscillators
N79-24737

RESOURCES MANAGEMENT
A systems procedure for land use and water quality planning in a rural watershed
N79-24406

RESPIRATION
Medical science in Siberia: Oxygen exchange in the Far North
[NASA-TM-75391] N79-24630

RESPIRATORY PHYSIOLOGY
User's instructions for the Grodins' respiratory control model using the UNIVAC 1110 remote batch and demand processing
[NASA-CR-160225] N79-24635

RESPIRATORY SYSTEM
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643

RETROREFLECTORS
Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821

REVERBERATION
Optimal detection in the presence of reverberation: Study and discussion of the stationary case
[CEPHAG-48/77] N79-24778

REVERSE FIELD PINCH
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838

REVERSE OSMOSIS
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110

RIBBONS
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431

RIGID STRUCTURES
Loaded shells with rigid mantels
[ISD-227] N79-24385

RINGS [MATHEMATICS]
Projections and measures
N79-24725

RIO GRANDE [NORTH AMERICA]
Recent vertical crustal movements from leveling observations in the Rio Grande rift: A review
[LA-UR-78-3195] N79-24589

ROBOTS
Proximity-vision system for protoflight manipulator arm
[NASA-CR-158652] N79-24658

ROCKET EXHAUST
Kinetic reaction coefficients in rocket exhaust plumes
[AD-A065646] N79-24059
ROCKET SOUNDING
Convective electric field measurements in an auroral plasma
N79-24552
ROCKET-BORNE INSTRUMENTS
Design, development, and flight of a spacecraft charging sounding rocket payload
N79-24009
Description and charging results from the RSPM
N79-24010
A rocket-borne electrostatic analyzer for measurement of energetic particle flux
[NASA-CR-158646] N79-24569
A rocket-borne pulse-height analyzer for energetic particle measurements
[NASA-CR-158645] N79-24570
A rocket-borne data-manipulation experiment using a microprocessor
[NASA-CR-158647] N79-24571
ROCKS
Types of karst, with emphasis on cover beds in their classification and development
N79-24556
ROLL
Roll-damping derivative calculations for spinning sharp and blunt cones in supersonic and hypersonic flow
[AD-A065594] N79-23927
ROLLER BEARINGS
Grease life estimation in rolling bearings
[ESDU-78032] N79-24344
The balance of rollers for high DN bearings
[AD-A065899] N79-24356
ROLLERS
The balance of rollers for high DN bearings
[AD-A065899] N79-24356
ROTARY WINGS
An investigation of a full-scale rotor with four blade tip planform shapes --- in Ames Research Center 40 by 80 Foot Wind Tunnel
[NASA-TM-78580] N79-23922
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931
A simplified rotor system mathematical model for piloted flight dynamics simulation
[NASA-TM-78575] N79-23977
ROTATING BODIES
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174
ROTATION
Engine rotor dynamics, synchronous and nonsynchronous whirl control
[AD-A066093] N79-23975
ROTOR AERODYNAMICS
An investigation of a full-scale rotor with four blade tip planform shapes --- in Ames Research Center 40 by 80 Foot Wind Tunnel
[NASA-TM-78580] N79-23922
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3A: Flow angle and velocity wake profiles in low frequency band, basic investigations and hub variations
[AD-A061766] N79-23932
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3B: Flow angle and velocity wake profiles in low frequency band, air ejector systems and other devices
[AD-A061767] N79-23933
Interactional aerodynamics of the single rotor helicopter configuration. Volume 2B: Harmonic analyses of airframe surface pressure data, runs 7 - 14, midsection
[AD-A061860] N79-23934
ROTORS
Numerical calculation of inviscid transonic flow through rotors and fans
N79-23906
RUBBER
Mechanisms of rubber abrasion
N79-24151
RUBIDIUM
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
Rubidium frequency standard test program for NAVSTAR GPS
N79-24745
RUBY LASERS
The holographic recording of a moving water aerosol
[BLL-TRANS-1370-[9022.549]]
N79-24322
RURAL AREAS
Impact of solar energy on rural housing
[GPO-31-641] N79-24467

S

SADDLE POINTS
Existence and approximations for saddle-point problems with application to nonlinear incompressible elasticity
N79-24365
SAFETY MANAGEMENT
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program --- concerning the use of radioisotopic power systems
[LA-7694-PR] N79-24801
SAILWINGS
A comparison of the aerodynamic characteristics of eight sailwing airfoil sections
N79-23897
SAMPLERS
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
SAMPLING
Motor gasolines, summer 1978
[BETC/PPS-79/1] N79-24189
Fluid sample collection and distribution system --- qualitative analysis of aqueous samples from several points
[NASA-CASE-MSC-16841-1] N79-24285
SANDS
Coefficients of friction between calcareous sands and some building materials, and their significance
[AD-A066297] N79-24198
SANDWICH STRUCTURES
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Electromagnetic fields in nonuniform multi-layered structures with engineering applications
[AD-A065515] N79-24228
SATELLITE ORBITS
Development of analytical orbit propagation technique with drag
[NASA-CR-160176] N79-23992
SABAB: A program for calculating satellite ephemerides
[REPT-10-78] N79-23993
SATELLITE PERTURBATION
Orbital theories of outer planet satellites
[NASA-CR-158667] N79-24925
SATELLITE POWER TRANSMISSION [TO EARTH]
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 1: Executive summary
[NASA-TM-80354] N79-24435
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 2: Detailed assessment
[NASA-TM-80355] N79-24436
SATELLITE ROTATION
Evolution of the rotation of an artificial earth satellite under the influence of a perturbing moment which is constant in fixed axes
[NASA-TM-75614] N79-23995
SATELLITE SOLAR POWER STATIONS
Magnetic shielding of large high-power-satellite solar arrays using internal currents
N79-24026
Space environmental effects and the solar power satellite
N79-24028
SATELLITE TRANSMISSION
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999
Comparative equatorial scintillation morphology: American and pacific sectors
[AD-A066094] N79-24224
SATELLITE-BORNE INSTRUMENTS
Polish Interkosmos participation described
N79-23991
SATELLITES
TEMPUS: A proposal for international time transfer and precision tracking satellite
N79-24760
SCALE MODELS
Model diffuser investigation for propulsion wind tunnel 16T
[AD-A065822] N79-23984
SCALING LAWS
Area scaling investigations of charging phenomena --- discharge pulse characteristics of Teflon thermal control tape
N79-24032
Scaling laws and edge effects for polymer surface discharges
N79-24041
SCANNERS
Analysis of a fractional gas stripper
N79-24084
SCATTERING
Spectral and scattering inverse problems
[PM/78/4] N79-24244
Nonlinear evolution equations associated with a massive Dirac system
[PM/78/5] N79-24705
Time delay in quantum scattering
N79-24885
SCATTERING CROSS SECTIONS
Measurements of the differential scattering cross sections of electron excited Na on Hg
[MPIS-13/1977] N79-24804
Neutron scattering on even isotopes of tin
N79-24870
SCENE ANALYSIS
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
SCHOOLS
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481
SCHOTTKY DIODES
Cuprous oxide photovoltaic cells --- fabricating schottky barrier devices
[PB-290529/7] N79-24514
SCHROEDINGER EQUATION
Relationship between Dirac and matrix Schroedinger inverse scattering transforms
[PM/78/6] N79-24072
A perturbation expansion for the nonlinear Schroedinger equation with application to the influence of nonlinear Landrau damping
[CTH-IEFT/PP-1977-12] N79-24845
Coupled nonlinear Schroedinger equations including growth and damping
[CTH-IEFT/PP-1977-14] N79-24847
SCINTILLATION
Comparison of signal scintillation models
[AD-A066102] N79-24227
A review of recent results on spread F theory
[AD-A066175] N79-24233
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577
SEA ICE
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea
[AD-A066336] N79-24586
SEA WATER
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096
A study to determine the mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater
[AD-A066257] N79-24130
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]]
N79-24600
Observations on the physico-chemical forms of cobalt, manganese, zinc, chromium and iron in sea water enriched or not with organic matter
[DRIC-TRANS-5370] N79-24625
SEALERS
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups --- sealers for aircraft structures
[NASA-CASE-ARC-11241-1] N79-24153
SEALS [STOPPERS]
Hydrodynamic lubrication with wear and asperity contact in mechanical face seals
[AD-A065924] N79-24357
SEARCH RADAR
SEATRACKS: A 35 GHz monopulse tracking radar
[AD-A065933] N79-24219
SEAS
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins
N79-24560
SEASAT-A SATELLITE
Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured vs. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Evaluation and analysis of Seasat-A scanning multichannel Microwave Radiometer [SMMR] Antenna Pattern Correction [APC] algorithm
[NASA-CR-158674] N79-24420
SECONDARY EMISSION
Stable dielectric charge distributions from field enhancement of secondary mission
N79-24046
Secondary emission effects on spacecraft charging: Energy distribution considerations
N79-24047
Secondary electron effects on spacecraft charging
N79-24048
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792

SEDIMENTS
Physical properties of sediments from the continental margin of western Africa
N79-24555
Types of karst, with emphasis on cover beds in their classification and development
N79-24556
Investigations of sediment cores from the central Pacific SE of Hawaii from the VALDIVIA cruise 13/1
[BMFT-FB-M-77-08] N79-24624

SEEBECK EFFECT
Factors influencing Seebeck effect of thin tellurium films
N79-24860

SEISMIC WAVES
Determination of earthquake source characteristics by computer simulation of teleseismic P-wave pulses
N79-24559
Direct methods for seismic profiling
[COO-2482-9] N79-24588

SEISMOGRAMS
A method for waveform inversion of body-wave seismograms
N79-24558

SEISMOLOGY
Seismic discrimination
[AD-A065574] N79-24578
Direct methods for seismic profiling
[COO-2482-9] N79-24588

SELECTION
The power of sequential model selection procedures
N79-24715

SELENIDES
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855

SELF FOCUSING
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339

SEMICONDUCTOR DEVICES
Development of measurement techniques for monitoring chemical purity of materials used in digital IC processing
[PB-291427/3] N79-24199
Manufacturing methods and technology engineering for tape chip carrier
[AD-A065890] N79-24270
Electron beam semiconductor devices. Citations from the NTIS data base
[NTIS/PS-79/0142/4] N79-24280
Electron beam semiconductor devices. Citations from the Engineering Index data base
[NTIS/PS-79/0143/2] N79-24281
Contactless measurement of carrier generation rate in semiconductors
[AD-A062880] N79-24876

SEMICONDUCTOR DIODES
High impact shock evaluation of the diode assembly design used in a 3000-horsepower generator
[AD-A066143] N79-24276

SEMICONDUCTORS [MATERIALS]
Semiconductor measurement technology: Microelectronic Processing Laboratory at NBS
[PB-291790/4] N79-24283
Investigation of low cost solar cells based on Cu2O
[PB-290940/6] N79-24516
Research on lattice-mismatched semi-conductor layers --- AlGaAsSb systems
[SAN-1250-4] N79-24880

SEMIEMPIRICAL EQUATIONS
A semiempirical approach for resonance Raman intensities
N79-24078

SEQUENTIAL ANALYSIS
Weak convergence of progressively censored likelihood ratio processes
N79-24712

SERIES EXPANSION
High-temperature series expansion for the singlet-triplet model
N79-24864

SERVICE LIFE
Grease life estimation in rolling bearings
[ESDU-78032] N79-24344

SET THEORY
F-normed ideals of spaces of measurable functions
N79-24686
Representing simple polytopes by order structures
N79-24688
Projections and measures
N79-24725
Some properties of condensing maps
[AD-A065630] N79-24726

SEWAGE
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911

SEWAGE TREATMENT
A recycled-water sanitary waste disposal system
[PB-291740/9] N79-24914

SHEAR LAYERS
A chemically reacting, turbulent shear layer
N79-24286

SHEAR STRENGTH
Structural properties of adhesives. Volume 2: Appendices. A: The symmetric lap shear test. B: Adhesive joint fabrication and test specifications
[AD-A065521] N79-24156

SHEAR STRESS
Optimal beam layouts: Allowance for cost of shear
[ISD-237] N79-24389

SHELL THEORY
Comparison of accuracies of solutions of linear shell theories for closed circular cylinders under edgewise loading
[NAL-TR-552T] N79-24370
Simple formulae for calculating the vibrational frequencies of plates, shells and membranes
[ARL-STRUC-REPT-371] N79-24374

SHELLS [STRUCTURAL FORMS]
Finite element analysis of arbitrary shells
N79-24368
Loaded shells with rigid mantels
[ISD-227] N79-24385

SHIPS
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recover from small ships. Volume 2: Appendices
[AD-A066173] N79-23955

SHOCK RESISTANCE
Acceleration sensitivity compensation in high performance crystal oscillators
N79-24735

SHOCK TESTS
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966
High impact shock evaluation of the diode assembly design used in a 3000-horsepower generator
[AD-A066143] N79-24276

SHORELINES
Effects of changes in upwind surface characteristics of mean wind speed and turbulence near a coastline
[BNL-25178] N79-24616

SIBERIA
Medical science in Siberia: Oxygen exchange in the Far North
[NASA-TM-75391] N79-24630

SIGNAL ANALYSIS
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930

SIGNAL DETECTION
Optimal detection in the presence of reverberation: Study and discussion of the stationary case
[CEPHAG-48/77] N79-24778

SIGNAL PROCESSING
Electrochemical detection device --- for use in microbiology
[NASA-CASE-LAR-11922-1] N79-24073
Direct sequence spread spectrum signalling
N79-24205
Signal processing with saw devices
[AD-A065520] N79-24223
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236
Spectral analysis by means of autoregressive filter
[CEPHAG-41/77] N79-24241
Comparative study of phase curves obtained by different methods for estimating cross spectral density. Geographic applications: Measure of phase shift and delay of PC 1 signals
[CEPHAG-4/78] N79-24243
Studies of photographic grain in a coherent optical system: Signal-dependence and its implications
[AD-A062528] N79-24325
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359
Multimode CPU design study
[AD-A066241] N79-24666
Digital system theory
[AD-A065764] N79-24681
Coded imaging systems using a Fourier aperture
N79-24818

SIGNAL RECEPTION
Deep ocean reception of acoustic signals emitted by a towed source
N79-24766

SIGNAL TO NOISE RATIOS
The monopulse performance of an optical heterodyne detector with varying LO distributions
[AD-A066253] N79-24238
New techniques for tracking sequences of digitized images
[AD-A066194] N79-24828

SIGNAL TRANSMISSION
Spectral characteristics of piecewise polynomial representation of digital signals
N79-24659

SIGNATURE ANALYSIS
Coded imaging systems using a Fourier aperture
N79-24818

SILICA GLASS
Fundamentals of ordinary ion exchange
N79-24094
A proton activation study of oxygen diffusion in multicomponent glass-forming systems
N79-24152

SILICON
Development of measurement techniques for monitoring chemical purity of materials used in digital IC processing
[PB-291427/3] N79-24199
Development and evaluation of die and container materials. Low cost silicon solar array project
[NASA-CR-158670] N79-24351
Study of the effects of impurities on the properties of silicon materials and performance of silicon solar cell
[NASA-CR-158678] N79-24447
LSA silicon material task closed-cycle process development
[NASA-CR-158677] N79-24449
LSA Large area Silicon sheet task continuous Czochralski process development
[NASA-CR-158675] N79-24451
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453
Analysis of the effects of impurities in silicon
[NASA-CR-157439] N79-24456
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
Effects of impurities and processing on silicon solar cells, phase 3
[NASA-CR-158569] N79-24472

SILICON ALLOYS
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129

SILICON COMPOUNDS
Development of a model and computer code to describe solar grade silicon production processes
[NASA-CR-158679] N79-24448

SILICON DIOXIDE
Fibrous refractory composite insulation --- shielding reusable spacecraft
[NASA-CASE-ARC-11169-1] N79-24062
Polymerization of sicica in aqueous solutions
N79-24149

SILICON FILMS
Laser-zone growth in a Ribbon-to-Ribbon [RTR] process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473

SILICON TRANSISTORS
Semiconductor measurement technology: Microelectronic Processing Laboratory at NBS
[PB-291790/4] N79-24283

SILVER BROMIDES
Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857

SILVER CHLORIDES
Anomalous ionic conductivity in silver bromide and silver chloride
N79-24857

SIMULATION
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023
Development of a modular software system for the dynamic simulation of coal conversion plants
[FE-2338-10] N79-24176
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
Simulation and control of advanced wastewater treatment systems
N79-24895

SINGLE CRYSTALS
Activity and selectivity of platinum single crystal surfaces and supported platinum catalysts for hydrocarbon reactions at atmospheric pressure
N79-24086

Carbon segregation on platinum, palladium and cobalt single crystal surfaces
N79-24853
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
Channeling of charged particles
N79-24945
SINTERED ALUMINUM POWDER
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128
SIZE [DIMENSIONS]
The effects of finite size on the critical behavior of fluid films
N79-24288
SKYNET SATELLITES
Skynet satellite electron precharging experiments
N79-24037
SLENDER CONES
Measurement of the drag of slender cones in hypersonic flow at low Reynolds numbers using a magnetic suspension and balance
[OUEL-1235/78] N79-23938
SLITS
Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910
SLOT ANTENNAS
An analysis of the mutual coupling between antennas on a smooth convex surface
[AD-A065591] N79-24211
An iterative approach for computing an antenna aperture distribution from given radiation pattern data
[AD-A065590] N79-24217
An investigation on characterizing mutual coupling between tow antenna slots on a cone
[AD-A066330] N79-24234
SLOTS
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
SLUDGE
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908
A recycled-water sanitary waste disposal system
[PB-291740/9] N79-24914
SLURRIES
Dynamics of a continuous thickener handling a compressible slurry
N79-24083
SMOG
Modelling of simulated photochemical smog with kinetic mechanisms. Volume 2: Appendix
[PB-290508/1] N79-24532
SNOW
Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582
Evaluation and prediction of avalanche hazard, San Juan Mountains, Colorado
[PB-290854/9] N79-24594
SOARING
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
Design of propellers for motorsoarers
N79-23903
SOCIAL FACTORS
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory --- for the demographic mapping program
[LBL-8707] N79-24894
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910
SOCIOLOGY
Significant characteristics of social response to noise and vibration
[NASA-TM-75412] N79-24888
SODIUM CARBONATES
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112
SODIUM COMPOUNDS
Some physical and chemical properties of sodium-aluminate solutions
[BLL-RTS-11347] N79-24074
SODIUM NITRATES
Sensitivity of burning rate to initial temperature for a binary magnesium-sodium nitrate mix
[AD-A066119] N79-24175
SODIUM VAPOR
Measurements of the differential scattering cross sections of electron excited Na on Hg
[MPIS-13/1977] N79-24804
SOIL MOISTURE
HCMM: Soil moisture in relation to geologic structure and lithology, northern California
[E79-10192] N79-24412
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536
SOILS
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
Dielectric measurements of five different soil textural types as functions of frequency and moisture content
[PB-291944/7] N79-24595
SOLAR ARRAYS
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024
Effect of parasitic plasma currents on solar-array power output
N79-24025
Magnetic shielding of large high-power-satellite solar arrays using internal currents
N79-24026
Space environmental effects and the solar power satellite
N79-24028
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031
TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053
A combined spacecraft charging and pulsed X-ray simulation facility
N79-24054
Development and evaluation of die and container materials. Low cost silicon solar array project
[NASA-CR-158670] N79-24351
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431
LSA silicon material task closed-cycle process development
[NASA-CR-158677] N79-24449
LSA Large area Silicon sheet task continuous Czochralski process development
[NASA-CR-158675] N79-24451
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459
The array automated assembly task for the low cost solar array project, phase 2
[NASA-CR-158538] N79-24469
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
Laser-zone growth in a Ribbon-to-Ribbon [RTR] process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473
Solar project cost report: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/60] N79-24482
Solar project description: Iris Images, Incorported, film laboratory, Mill Valley, California
[SOLAR/2005-78/50] N79-24486
Performance testing of the McDonnell Douglas fresnel lens solar collector
[SAND-78-0625] N79-24512
SOLAR CELLS
High energy proton radiation damage to [AlGa]As-GaAs solar cells
[NASA-CR-3148] N79-24261
Study of the effects of impurities on the properties of silicon materials and performance of silicon solar cell
[NASA-CR-158678] N79-24447
Development of pulsed processes for the manufacture of solar cells
[NASA-CR-158676] N79-24450
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453
Development of high efficiency [14%] solar cell array module
[NASA-CR-158672] N79-24454
Automated solar panel assembly line. LSA task; production processes and equipment
[NASA-CR-158671] N79-24455
Analysis of the effects of impurities in silicon
[NASA-CR-157439] N79-24456
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
Effects of impurities and processing on silicon solar cells, phase 3
[NASA-CR-158569] N79-24472
Application and system design study for cost-effective solar photovoltaic systems at Federal installations
[HCP/CS-0306] N79-24500
Cuprous oxide photovoltaic cells --- fabricating schottky barrier devices
[PB-290529/7] N79-24514
Investigation of low cost solar cells based on Cu2O
[PB-290940/6] N79-24516
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877
Research on lattice-mismatched semi-conductor layers --- AlGaAsSb systems
[SAN-1250-4] N79-24880
SOLAR COLLECTORS
Cost-effective potential of optimumly designed heat pumps for the collection, storage, and distribution of solar energy
[BNL-25195] N79-24307
Primary reflector for solar energy collection systems and method of making same
[NASA-CASE-NPO-13579-3] N79-24432
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
Comparison of three experimental methods used in determining the thermal performance of flat-plate solar collectors
N79-24434
Development of a model and computer code to describe solar grade silicon production processes
[NASA-CR-158679] N79-24448
Thermal power systems, point-focusing distributed receiver technology project. Volume 2: Detailed report
[NASA-CR-158534] N79-24464
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers --- solving the heat transfer problem
[NASA-CR-158640] N79-24466
Solar project cost report: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/60] N79-24482
Solar project description. Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/50] N79-24496
Solar project description. Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/50] N79-24498
Solar project description. Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/50] N79-24499
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513
SOLAR COOLING
Prototype solar heating and cooling systems
[NASA-CR-161204] N79-24437
Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
Solar project description. Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/50] N79-24496
SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
Swedish solar energy projects, 1978
[SIB-D-13-1978] N79-24502
SOLAR ENERGY
Cost-effective potential of optimumly designed heat pumps for the collection, storage, and distribution of solar energy
[BNL-25195] N79-24307
Solar technology in the Federal Republic of Germany
[NASA-TM-75634] N79-24439
Impact of solar energy on rural housing
[GPO-31-641] N79-24467
Energy Materials Coordinating Committee [EMACC]
[DOE/US-002] N79-24490
Solar energy commercialization for European countries, volume 2
[HCP/CS-4250-VOL-2] N79-24493

SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
Swedish solar energy projects, 1978
[SIB-D-13-1978] N79-24502
SOLAR ENERGY ABSORBERS
Chemical and optical studies of heat transfer fluids containing solar energy absorbers
[MLM-2549[OP]] N79-24505
SOLAR ENERGY CONVERSION
Description of photovoltaic village power systems in the United States and Africa
[NASA-TM-79149] N79-24443
Thermal Storage Applications Workshop. Volume 1: Plenary Session Analysis
[NASA-CR-158643] N79-24460
Thermal Storage Applications Workshop. Volume 2: Contributed Papers
[NASA-CR-158644] N79-24461
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462
High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
Thermal power systems, point-focusing distributed receiver technology project. Volume 2: Detailed report
[NASA-CR-158534] N79-24464
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
Solar project cost report: Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/60] N79-24483
Solar project description: Aratex Services, Incorporated, industrial laundry, Fresno, California
[SOLAR/2008-78/50] N79-24485
Solar project description: Iris Images, Incorported, film laboratory, Mill Valley, California
[SOLAR/2005-78/50] N79-24486
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497
Research at Sandia Laboratories for Solar Thermal Large Power Systems Program
[SAND-78-8051] N79-24510
Performance testing of the McDonnell Douglas fresnel lens solar collector
[SAND-78-0625] N79-24512
SOLAR FURNACES
Treatment of molybdenite ore using a 2 kW solar furnace
[LA-UR-79-6] N79-24478
SOLAR HEATING
Heat pumps. Citations from the NTIS data base --- a bibliography with abstracts
[NTIS/PS-79/0232/3] N79-24316
Heat pumps, volume 1. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0233/1] N79-24317
Heat pumps, volume 2. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0234/9] N79-24318
Prototype solar heating and cooling systems
[NASA-CR-161204] N79-24437
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481
Solar project cost report: Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/60] N79-24484
Solar project cost report. Iris Images, Incorporated, Film Laboratory, Mill Valley, California
[SOLAR/2005-78/60] N79-24494
Solar project cost report. Aratex Services, Inc., Industrial Laundry, Fresno, California
[SOLAR/2008-78/60] N79-24495
Solar project description. Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/50] N79-24496
SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
Swedish solar energy projects, 1978
[SIB-D-13-1978] N79-24502
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513
SOLAR HOUSES
Impact of solar energy on rural housing
[GPO-31-641] N79-24467
Solar project cost report: Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/60] N79-24483
Solar project description. Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/50] N79-24498
Solar project description. Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/50] N79-24499
SOLAR PHYSICS
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932
SOLAR RADIATION
Atmospheric neutrons
[NASA-CR-3126] N79-24631
Scattering of solar radiation by clouds
[AD-A062828] N79-24826
SOLAR REFLECTORS
Investigation of electrostatic discharge phenomena on conductive and non-conductive solar reflectors
N79-24043
Primary reflector for solar energy collection systems and method of making same
[NASA-CASE-NPO-13579-3] N79-24432
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
SOLAR WIND
Digest of equipment for converting solar, wind, and geothermal energy into electric power for USN application ashore
[AD-A066221] N79-24475
Research activities of the Institute of Extraterrestrial Physics --- plasma and particle phenomena
[MPI-PAE-EXTRATERR-141] N79-24936
SOLDERING
Deleterious effect of MIL-F-14256, type RA fluxes on printed wiring boards
[AD-A066129] N79-24274
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431
SOLENOID VALVES
Bistable [latching] solenoid actuated propellant isolation valve
[NASA-CR-158673] N79-24352
SOLID PROPELLANTS
Solid propellant combustion mechanism research
[AD-A065761] N79-24173
Densified biomass: A new form of solid fuel
[SERI-35] N79-24180
SOLID ROCKET PROPELLANTS
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174
Inorganic halogen oxidizer research
[AD-A066149] N79-24177
SOLID WASTES
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468
The economic impact analysis of effluent standards for total dissolved solids
[PB-290916/6] N79-24541
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908
SOLIDIFICATION
Metallic xenon
N79-24118
Low-cost directionally-solidified turbine blades, volume 1
[NASA-CR-159464] N79-24121
SOLIDS
Photoacoustic spectroscopy: Its application to the study of soiid materials
N79-24081
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas
N79-24730
SOLITARY WAVES
A perturbation expansion for the nonlinear Schroedinger equation with application to the influence of nonlinear Landrau damping
[CTH-IEFT/PP-1977-12] N79-24845
SOLUBILITY
A study of miscibility in blends of polycarbonate with polyesters
N79-24150
SOLVENT EXTRACTION
Solvent Refined Coal [SRC] process: Operation of solvent refined coal pilot plant
[FE-2270-34] N79-24181
SONAR
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea
[AD-A066336] N79-24586
SONIC BOOMS
Aircraft sonic boom: Effects on buildings. A bibliography with abstracts
[NTIS/PS-79/0265/3] N79-24201
Aircraft sonic boom: Biological effects. A bibliography with abstracts
[NTIS/PS-79/0190/3] N79-24650
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780
SORPTION
Effect of annealing below the glass transition temperature on sorption and transport of carbon dioxide in polycarbonate
N79-24148
SOUND PROPAGATION
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775
SOUND TRANSMISSION
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
SOUND WAVES
JSEP achievements 1961-1978 [update of 15-year report dated September 1976]
[AD-A065670] N79-24271
Temperature dependence of the velocity of ultrasound in mammalian tissue
N79-24767
SOUNDING ROCKETS
Design, development, and flight of a spacecraft charging sounding rocket payload
N79-24009
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R --- low gravity crystallization of a 27.8 percent ammonium chloride
[NASA-CR-161224] N79-24295
SOUTH AFRICA
Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609
Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610
SOUTH DAKOTA
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
SOVIET SPACECRAFT
Preliminary results of the determination of the orientation of Interkosmos-17 AUOS
[NASA-TM-75613] N79-23994
SOYBEANS
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
SOYUZ SPACECRAFT
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938
Experiments of USSR-CSSR cosmic flight described
N79-24939
SPACE HEATING (BUILDINGS)
Heat pumps. Citations from the NTIS data base --- a bibliography with abstracts
[NTIS/PS-79/0232/3] N79-24316
Heat pumps, volume 1. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0233/1] N79-24317
Heat pumps, volume 2. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0234/9] N79-24318
Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481
SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513
SPACE MISSIONS
Advanced planetary studies
[NASA-CR-158657] N79-24915
Multiple Discipline science assessment --- considering astronomy, astrophysics, cosmology, gravitation and geophysics when planning planetary missions
[NASA-CR-158656] N79-24916
Experiments of USSR-CSSR cosmic flight described
N79-24939
SPACE NAVIGATION
PTTI applications to deep space navigation
N79-24759
SPACE PROGRAMS
US civilian space policy
[GPO-42-110] N79-23988

Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
Polish Interkosmos participation described
N79-23991
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938

SPACE SHUTTLE ORBITERS
Development of a prototype flexible radiator system
[NASA-CR-160166] N79-24299
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program --- for the space shuttle orbiter
[NASA-CR-160178] N79-24672

SPACE SHUTTLES
Five year plan for space test program
[AD-A065866] N79-23989
Standard test rack. Concept definition study. Structural analysis report
[AD-A066247] N79-23998

SPACE SUITS
Spacesuit mobility knee joints
[NASA-CASE-ARC-11058-2] N79-24651

SPACE TRANSPORTATION SYSTEM
US civilian space policy
[GPO-42-110] N79-23988
A turbojet-boosted two-stage-to-orbit space transportation system design study
[NASA-CR-159018] N79-23997

SPACEBORNE EXPERIMENTS
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938
Experiments of USSR-CSSR cosmic flight described
N79-24939

SPACECRAFT CHARGING
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Description of the Space Test Program P78-2 spacecraft and payloads
N79-24002
Modeling of the geosynchronous plasma environment
N79-24003
Average plasma environment at geosynchronous orbit
N79-24004
ATS-5 and ATS-6 potentials during eclipse
N79-24005
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source
N79-24006
Operations of the ATS-6 ion engine
N79-24007
Characteristics of differential charging of ATS-6
N79-24008
Design, development, and flight of a spacecraft charging sounding rocket payload
N79-24009
Description and charging results from the RSPM
N79-24010
The capabilities of the NASA charging analyzer program
N79-24011
Charging analysis of the SCATHA satellite
N79-24012
Comparison of NASCAP predictions with experimental data
N79-24013
Spacecraft charging results for the DSCS-3 satellite
N79-24014
Prediction of ion drift effects on spacecraft floating potentials
N79-24015
Numerical calculations of high-altitude differential charging: Preliminary results
N79-24016
Analytical study of the time dependent spacecraft-plasma interaction
N79-24017
Electron transport model of dielectric charging
N79-24018
The calculation of spacecraft potential: Comparison between theory and observation
N79-24019
Spacecraft potential control on ISEE-1
N79-24020
Interactions between spacecraft and the charged-particle environment
N79-24021
Plasma Interaction Experiment [PIX] flight results
N79-24022
Environmental interaction implications for large space systems
N79-24027
Space environmental effects and the solar power satellite
N79-24028
Status of materials characterization studies
N79-24030
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031
Area scaling investigations of charging phenomena --- discharge pulse characteristics of Teflon thermal control tape
N79-24032
Charging rates of metal-dielectric structures --- with implications for spacecraft
N79-24033
Materials and techniques for spacecraft static charge control 2
N79-24034
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
Skynet satellite electron precharging experiments
N79-24037
Potential mapping with charged-particle beams
N79-24038
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control
N79-24040
Scaling laws and edge effects for polymer surface discharges
N79-24041
Thermal blanket metallic film groundstrap and second surface mirror vulnerability to arc discharges
N79-24042
Parameter dependence of equilibrium charging potentials
N79-24045
Stable dielectric charge distributions from field enhancement of secondary mission
N79-24046
Secondary emission effects on spacecraft charging: Energy distribution considerations
N79-24047
Secondary electron effects on spacecraft charging
N79-24048
Geosynchronous satellite operating anomalies caused by interaction with the local spacecraft environment
N79-24049
Spacecraft charging standard
N79-24050
Spacecraft charging modeling development and validation study
N79-24051
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053
A combined spacecraft charging and pulsed X-ray simulation facility
N79-24054
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055
Further development of the multipactor discharge electron source
N79-24057

SPACECRAFT COMPONENTS
Characteristics of differential charging of ATS-6
N79-24008

SPACECRAFT CONSTRUCTION MATERIALS
Electrostatic discharge properties of selected Voyager spacecraft materials
N79-24039
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066

SPACECRAFT CONTROL
Operator performance and localized muscle fatigue in a simulated space vehicle control
N79-24653

SPACECRAFT DESIGN
Spacecraft charging standard
N79-24050

SPACECRAFT ENVIRONMENTS
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Description of the Space Test Program P78-2 spacecraft and payloads
N79-24002
Modeling of the geosynchronous plasma environment
N79-24003
Average plasma environment at geosynchronous orbit
N79-24004
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source
N79-24006

SPACECRAFT GUIDANCE
Aerospace computer systems. Part 2: Space and guided missile applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0314/9] N79-23961
Aerospace computer systems. Part 2: Space and guided missile applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0315/6] N79-23962

SPACECRAFT INSTRUMENTS
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2
N79-24056
Performance of preproduction model cesium beam frequency standards for spacecraft applications
N79-24740

SPACECRAFT POWER SUPPLIES
NASCAP modelling of high-voltage power system interactions with space charged-particle environments
[NASA-TM-79146] N79-24000
Module failure isolation circuit for paralleled inverters --- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254

SPACECRAFT RADIATORS
Development of a prototype flexible radiator system
[NASA-CR-160166] N79-24299

SPACECRAFT STRUCTURES
Interactions between spacecraft and the charged-particle environment
N79-24021

SPACECREWS
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642

SPACELAB
ATMOS Spacelab 1 science investigation
[NASA-TM-80465] N79-24568

SPAIN
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757

SPARK IGNITION
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345

SPATIAL DISTRIBUTION
Spatial characteristics of net radiation and its components for Ontario
N79-24562
Temporal and spatial distribution of humidity in a small city
N79-24599
A theoretical study into the spatial distribution of atoms surrounding an individual solute particle vaporizing in an analytical flame
[AD-A066182] N79-24796
Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835

SPECIFIC HEAT
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855

SPECIFICATIONS
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641

SPECKLE PATTERNS
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221

SPECTRA
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839

SPECTROGRAMS
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931

SPECTROMETERS
The measurement of absolute pair production cross-sections at near-threshold energies and the development of a high resolution position spectrometer
N79-24783

SPECTROPHOTOMETRY
Photoacoustic spectroscopy: Its application to the study of solid materials
N79-24081

SPECTROSCOPIC ANALYSIS
Spectroscopic investigations of metal cation reduction at glass surfaces
N79-24079
Multiphoton spectroscopy of Cs-inert gas --- using a high power laser
N79-24781

SPECTROSCOPY
Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835
SPECTRUM ANALYSIS
Spectroelectrochemical studies of fast reactions N79-24082
The theory of spectrum analysis of stochastic processes
[REPT-0-78] N79-24109
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236
Spectral analysis by means of autoregressive filter
[CEPHAG-41/77] N79-24241
Spectral and scattering inverse problems
[PM/78/4] N79-24244
GaAs waveguide detector array for an IOC spectrum analyzer
[AD-A065824] N79-24265
Spectral characteristics of piecewise polynomial representation of digital signals N79-24659
Acoustic emission spectral calibration and analysis --- using a helium jet
[ARL-MAT-NOTE-125] N79-24772
A magnetic study of the spotted UV Ceti flare stars and related late-type dwarfs N79-24918
SPECULAR REFLECTION
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin N79-24868
SPHERES
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Spectral and scattering inverse problems
[PM/78/1] N79-24394
Numerical simulation of spherically symmetric matter in relativity N79-24883
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations N79-24886
SPHERICAL HARMONICS
A primitive equation spectral model for the study of stratospheric sudden warmings N79-24546
A theory of anharmonic effects in vibrational nuclei --- nonlinear equations of motion method N79-24809
SPINEL
Local site distortion model of magnetostriction
[AD-A066250] N79-24763
SPIRAL GALAXIES
Collisionless galaxy simulations
[NASA-RP-1037] N79-24921
A photometric and kinematic study of the barred spiral galaxy NGC 253 N79-24923
SPLINE FUNCTIONS
Optimality of spline algorithms
[AD-A065637] N79-24674
SPREAD SPECTRUM TRANSMISSION
Direct sequence spread spectrum signalling N79-24205
Effects of antenna arrays on broadband signals
[AD-A064679] N79-24231
SPUTTERING
Ion beam sputter deposition of fluoropolymers
[NASA-CASE-LEW-13122-1] N79-24154
Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing N79-24858
Studies of calcium isotope fractionation found in nature and produced during ion sputtering N79-24927
STABILITY
Anomalous plasma transport due to electron temperature gradient instability
[IPPJ-369] N79-24833
Collisionless tearing instabilities
[IPPJ-370] N79-24834
Stability and degradation of superconducting current-carrying devices
[LA-7275] N79-24879
STAGE SEPARATION
A turbojet-boosted two-stage-to-orbit space transportation system design study
[NASA-CR-159018] N79-23997
STAINLESS STEELS
Corrosion of stainless steel, volume 2. A bibliography with abstracts
[NTIS/PS-79/0208/3] N79-24143
STANDARDIZATION
Avionics standardization potential analysis
[AD-A066138] N79-23958
STANDARDS
Measurement assurance for gage blocks
[PB-292020/5] N79-24200
Activities of the National Bureau of Standards nondestructive evaluation program for fiscal year 1978: Summary
[PB-291946/2] N79-24362
Impact tests on crash helmets for motor cyclists
[AD-A065966] N79-24655
STAR TRACKERS
Design, fabrication, and delivery of a charge injection device as a stellar tracking device
[NASA-CR-161226] N79-24919
STARTING
Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330
STATIC PRESSURE
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969
STATIC TESTS
Status of materials characterization studies N79-24030
STATISTICAL ANALYSIS
Safety hazard of aircraft icing N79-23916
The distribution of maximum wind speed
[BLL-TRANS-1368-[9022.549]] N79-24601
A simple method for an objective, local forecast of gusts
[BLL-TRANS-1393-[9022.549]] N79-24604
Waiting times and return periods related to order statistics N79-24708
A statistical rationale for relating situational attributes and individual differences
[AD-A066088] N79-24718
Statistical comparisons of aircraft flyover noise adjustment procedure for different weather conditions
[NASA-TP-1430] N79-24773
STATISTICAL DISTRIBUTIONS
The power of sequential model selection procedures N79-24715
STATISTICAL TESTS
The power of sequential model selection procedures N79-24715
STATISTICAL WEATHER FORECASTING
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608
STEADY STATE
User's instructions for the 41-node thermoregulatory model [steady state version]
[NASA-CR-160220] N79-24638
STEAM
Steam reforming of aromatic compounds N79-24093
STEELS
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
Predicting stress corrosion cracking in welded steel based on residual stress measurements
[BDX-613-2099-REV] N79-24131
Hydrogen embrittlement of metals, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0177/0] N79-24135
Hydrogen embrittlement of metals, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/0178/8] N79-24136
Hydrogen embrittlement of metals, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0179/6] N79-24137
Hydrogen embrittlement of metals. Citations from the American Petroleum Institute data base
[NTIS/PS-79/0180/4] N79-24138
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
Critical experiments, measurements and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[PB-291190/7] N79-24405
STEERING
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657
STELLAR MASS
Fluid spheres in general relativity: Exact solutions and applications to astrophysics --- neutron stars, stellar mass and Einstein's field equations N79-24886
STELLARATORS
Stabilization of magnetohydrodynamic instabilities in a current-carrying stellarator
[IPPJ-368] N79-24836
STIFFENING
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376
STIFFNESS
An evaluation of stiffness reduction as a damage parameter and criterion for fatigue failure in composite materials N79-24063
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings
[AD-A065554] N79-24355
Development of procedures for calculating stiffness and damping of elastomers in engineering applications. Part 5: Elastomer performance limits and the design and test of an elastomer damper
[NASA-CR-159552] N79-24373
STIFFNESS MATRIX
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386
On large displacement-small strain analysis of structures with rotational degrees of freedom
[ISD-247] N79-24392
STOCHASTIC PROCESSES
The theory of spectrum analysis of stochastic processes
[REPT-0-78] N79-24109
An impulse control policy for a class of jump diffusion processes
[CSIR-T-WISK-55] N79-24698
The optimal tracking problem for nonstationary stochastic processes
[AD-A062689] N79-24700
A modified Robbins-Monro procedure and its applications N79-24716
Generation of non-homogeneous poisson processes by thinning: Programming considerations and comparison with competing algorithms
[AD-A066345] N79-24719
Calculation of the Kolmogorov entropy for motion along a stochastic magnetic field
[PPPL-1523] N79-24765
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation N79-24896
STOICHIOMETRY
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
STORAGE BATTERIES
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445
STORAGE STABILITY
Stability characteristics of hydrocarbon fuels from alternative sources
[BETC/RI-78/23] N79-24178
Preliminary long-term stability criteria for compressed air energy storage caverns in salt domes
[PNL-2871] N79-24487
STORMS
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911
STRAIN GAGES
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 1
[LBF-TB-111-VOL-1] N79-24400
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 2
[LFB-TB-112-VOL-2] N79-24401
STRATIFICATION
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
STRATOSPHERE
A primitive equation spectral model for the study of stratospheric sudden warmings N79-24546
Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567
STRATUS CLOUDS
A comparison of theoretical and experimental results in supercooled stratus dispersal
[AD-A063013] N79-24581

STREAMS
Stream channel modification in Hawaii, part A: Statewide inventory of streams, habitat factors and associated biota
[PB-290571/9] N79-24425
STRESS [PHYSIOLOGY]
Stress and fatigue in the driving environment --- physiological and psychological effects of heat and noise experienced inside automobiles
N79-24629
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
STRESS ANALYSIS
Fundamentals of ordinary ion exchange
N79-24094
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396
Stress crack phenomena volume 3. A bibliography with abstracts
[NTIS/PS-79/0269/5] N79-24403
Stress crack phenomena volume 4. A bibliography with abstracts
[NTIS/PS-79/0270/3] N79-24404
STRESS CONCENTRATION
Inelastic resistance calculations with time dependent thermal and mechanical stress
[ISD-238] N79-24390
The Boussinesq and Cerruti solutions for a transversely isotropic half-space
[OUEL-1232/78] N79-24397
STRESS CORROSION CRACKING
Predicting stress corrosion cracking in welded steel based on residual stress measurements
[BDX-613-2099-REV] N79-24131
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
STRESS FUNCTIONS
Optimum plastic design of a variable-thickness orthotropic plate under in-plane loading
[OUEL-1237/78] N79-24398
STRESS MEASUREMENT
Magnetomechanical acoustic emission of iron and steels --- measuring residual stress
[AD-A066082] N79-24125
STRESS TENSORS
The Boussinesq and Cerruti solutions for a transversely isotro_pic half-space
[OUEL-1232/78] N79-24397
Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607
STRESSES
Contact phenomena. 1: Stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components
[ESDU-78035] N79-24369
STRIPPING [DISTILLATION]
Analysis of a fractional gas stripper
N79-24084
STRUCTURAL ANALYSIS
Low-speed single-element airfoil synthesis
N79-23890
Some new airfoils
N79-23896
Standard test rack. Concept definition study. Structural analysis report
[AD-A066247] N79-23998
The fatigue of Ti6Al4V alloy in coarse and fine structural conditions under fully reverse loading as well as pulsating tension
N79-24119
Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371
ANALYZE: Analysis of aerospace structures with membrane elements
[AD-A065633] N79-24379
Thermomechanical calculations for massive structures using a finite element method
[ISD-234] N79-24387
Wind engineering research digest, volume 3, 1978 --- a bibliography of ongoing research projects
[PB-290694/9] N79-24621
STRUCTURAL BASINS
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins
N79-24560
STRUCTURAL DESIGN
Low-speed single-element airfoil synthesis
N79-23890
Optimum tail plane design for sailplanes
N79-23892
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control
N79-23895
Some new airfoils
N79-23896
Design of propellers for motorsoarers
N79-23903
Substructuring methods for design sensitivity analysis and structural optimization
[AD-A065935] N79-23949
Fail-safe optimal design of structures with substructuring
[AD-A065936] N79-23950
Design, fabrication and test of a hydrogen heat pipe --- extruding and grooving 6063-T6 aluminum tubes for cryogenic heat pipes
[NASA-CR-152267] N79-24298
Optimum plastic design of a variable-thickness orthotropic plate under in-plane loading
[OUEL-1237/78] N79-24398
Solar project description. Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/50] N79-24498
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
STRUCTURAL DESIGN CRITERIA
A class of structural optimization problems: Optimal archgrids
[ISD-236] N79-24388
A method for deriving statistical parameters for design against random stresses resulting from working operations
[LFB-FB-135] N79-24402
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438
STRUCTURAL ENGINEERING
Dynamic structural analysis with substructures
[AD-A065937] N79-24378
An analytical approach to wind velocity gust factors
[OUEL-1241/78] N79-24620
STRUCTURAL PROPERTIES (GEOLOGY)
Spectral and scattering inverse problems
[PM/78/1] N79-24394
STRUCTURAL RELIABILITY
Structural properties of adhesives, volume 1
[AD-A065500] N79-24155
STRUCTURAL STABILITY
Vibration and stability of beam reinforced polar orthotropic annular plates of uniform and variable thickness
N79-24363
STRUCTURAL STRAIN
On large displacement-small strain analysis of structures with rotational degrees of freedom
[ISD-247] N79-24392
Note on large strain applications of a modified constant strain finite element method
[ISD-248] N79-24393
STRUCTURAL VIBRATION
Vibration and stability of beam reinforced polar orthotropic annular plates of uniform and variable thickness
N79-24363
Flexural vibrations of annular plates under uniform inplane compressive forces --- using Rayleigh-Ritz method
N79-24375
STURM-LIOUVILLE THEORY
Spectral and scattering inverse problems
[PM/78/4] N79-24244
STYRENES
The high temperature aqueous modification of polybutadiene and a styrene crosslinked unsaturated polyester
N79-24145
SUBMERGED BODIES
Deep ocean reception of acoustic signals emitted by a towed source
N79-24766
SUBMILLIMETER WAVES
Characteristics of fast response InSb submillimeter detector --- for measuring electron cyclotron emission from tokamak plasmas
[IPPJ-T-31] N79-24839
SUBROUTINE LIBRARIES [COMPUTERS]
Non-linear model fitting and function minimisation package
[OUEL-1194/77] N79-24706
SUBROUTINES
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
Investigation of micropulsation activity
[AD-A066344] N79-24668
SUBSONIC FLOW
Numerical optimization techniques for bound circulation distribution for minimum induced drag of nonplanar wings: Basic formulations
[NASA-CR-3154] N79-23924
SUBSTRATES
Electrodeposition painting of metal substrates: Pinholing in surface films
[AD-A065968] N79-24160
SUBSTRUCTURES
Substructuring methods for design sensitivity analysis and structural optimization
[AD-A065935] N79-23949
SUCTION
Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910
SULFIDES
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855
High resolution electron microscopy of sulfides
N79-24863
SULFONES
Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168
SULFUR
Flexural behavior of reinforced sulfur-infiltrated concrete beams
N79-24196
SULFUR DIOXIDES
Laboratory investigation of the photooxidation and catalytic oxidation of SO2
[PB-290859/8] N79-24533
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534
SULFUR OXIDES
Selective transport of sulfur-dioxide through polymer membranes
N79-24089
SUPERCHARGERS
Two-stage supercharger sets: Efficiency and head distribution under full- and part-load conditions
[RTS-11613] N79-24342
SUPERCONDUCTING MAGNETS
Magnetization effects in superconducting accelerator magnets
[BNL-24939] N79-24815
SUPERCONDUCTIVITY
Local electronic properties of dilute magnetic alloys
N79-24114
Quartz crystal and superconductive resonators and oscillators
N79-24737
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
SUPERCONDUCTORS
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277
Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum
N79-24862
Cylindrical Josephson tunneling
N79-24871
Stability and degradation of superconducting current-carrying devices
[LA-7275] N79-24879
SUPERCOOLING
A comparison of theoretical and experimental results in supercooled stratus dispersal
[AD-A063013] N79-24581
SUPERFLUIDITY
The viscosity of normal and superfluid helium three
N79-24861
An investigation of effects associated with thermal counterflow in rotating superfluid helium
N79-24869
Superfluid 3He in narrow cylinders --- nuclear magnetic resonance
N79-24873
SUPERHETERODYNE RECEIVERS
The monopulse performance of an optical heterodyne detector with varying LO distributions
[AD-A066253] N79-24238
SUPERNOVA REMNANTS
A study of molecular clouds near supernova remnants
N79-24924
SUPERPLASTICITY
Composite materials with superplastic matrix
[BLL-RTS-11722] N79-24064
SUPERSONIC FLOW
Roll-damping derivative calculations for spinning sharp and blunt cones in supersonic and hypersonic flow
[AD-A065994] N79-23927

Theory of thin wing in a supersonic flow with consideration of the non-equilibrium state of excitation of oscillating degrees of freedom
[AD-A065992] N79-23928
Supersonic flow in the area of antisymmetric thin cruciform wings with supersonic leading edges in a horizontal plane, with consideration of flow separation on the edges
[AD-A065993] N79-23929

SUPERSONIC TRANSPORTS
Characteristics of the advanced supersonic technology AST-105-1 configured for transpacific range with Pratt and Whitney aircraft variable stream control engines
[NASA-TM-78818] N79-23888

SURFACE ACOUSTIC WAVE DEVICES
Signal processing with saw devices
[AD-A065520] N79-24223
Photolithographic techniques for Surface Acoustic Wave [SAW] devices. Volume 2: Technical and operational parts 1 and 2
[AD-A065566] N79-24774

SURFACE DIFFUSION
Diffusion and heat transfer in a plane horizontal film
[REPT-77-2] N79-24309
Gravity waves and diffusion in a liquid covered by a superficial film
[REPT-77-3] N79-24310

SURFACE ENERGY
Description and charging results from the RSPM N79-24010

SURFACE PROPERTIES
Status of materials characterization studies N79-24030
Activity and selectivity of platinum single crystal surfaces and supported platinum catalysts for hydrocarbon reactions at atmospheric pressure N79-24086
On the axisymmetric contact of closely conforming elastic bodies N79-24364
Contact phenomena. 1: Stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components
[ESDU-78035] N79-24369

SURFACE REACTIONS
Interactions between spacecraft and the charged-particle environment N79-24021
Plasma Interaction Experiment [PIX] flight results N79-24022
Activity and selectivity of platinum single crystal surfaces and supported platinum catalysts for hydrocarbon reactions at atmospheric pressure N79-24086
Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing N79-24858

SURFACE ROUGHNESS
The effect of disturbance on a wing N79-23893

SURFACE TEMPERATURE
Subsurface temperatures from surface heat flow data using equivalent plane sources N79-24561
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]] N79-24600

SURFACE VEHICLES
Evaluation of a flywheel-powered shuttle car
[FE-8890] N79-24488
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657

SURFACTANTS
Studies in the theory and practices of foam flotation techniques N79-24077

SWITCHING CIRCUITS
Module failure isolation circuit for paralleled inverters --- preventing system failure during power conditioning for spacecraft applications
[NASA-CASE-NPO-14000-1] N79-24254

SWITZERLAND
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-[9022.549]] N79-24602

SYMMETRY
On the axisymmetric contact of closely conforming elastic bodies N79-24364

SYMPHONIE SATELLITES
Clock synchronisation experiment in India using symphonie satellite N79-24758

SYNCHRONISM
Precise terrestrial time: A means for improved ballistic missile guidance analysis N79-24736
Overview of timing/synchronization for digital communications N79-24746
Survey of timing/synchronization of operating wide-band digital communications networks N79-24747
An Evaluation of optional timing/synchronization features to support selection of an optimum design for the DCS digital communication network N79-24748
Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network N79-24749
Clock synchronisation experiment in India using symphonie satellite N79-24758

SYNCHRONOUS SATELLITES
Description of the Space Test Program P78-2 spacecraft and payloads N79-24002

SYNTHETIC ARRAYS
Multiple antenna beam formation techniques for synthetic aperture radar N79-24206

SYSTEM EFFECTIVENESS
Spacecraft charging modeling development and validation study N79-24051
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438
Effects of air damper leaks on solar energy system performance
[SOLAR/0012-78/29] N79-24497
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513

SYSTEMS ANALYSIS
Analytical methods for biotechnological design of man machine systems: Work on system ergonomy
[FB-28] N79-24315
Solar project description. Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/50] N79-24496
The application of sensitivity analysis to models of large scale physiological systems
[NASA-CR-160228] N79-24645

SYSTEMS ENGINEERING
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
Conceptual design for advanced coal liquefaction commercial plant
[FE-2251-52] N79-24182
Development and implementation of productivity measurement systems with emphasis on interorganization relationships N79-24195
Nd:YAG development for spaceborne laser ranging system
[NASA-CR-159932] N79-24329
Prototype solar heating and cooling systems
[NASA-CR-161204] N79-24437
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462
Application and system design study for cost-effective solar photovoltaic systems at Federal installations
[HCP/CS-0306] N79-24500
Computational design alternatives with microprocessor-based systems N79-24664
Identification and order reduction of dynamical systems N79-24723
Introduction to systems approach N79-24732
A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892
Service methods demonstration program
[PB-292008/0] N79-24898
Design, fabrication, and delivery of a charge injection device as a stellar tracking device
[NASA-CR-161226] N79-24919

SYSTEMS MANAGEMENT
Development and implementation of productivity measurement systems with emphasis on interorganization relationships N79-24195

SYSTEMS STABILITY
Robust stability of linear systems: Some computational considerations
[NASA-CR-158620] N79-24695

T

TABLES [DATA]
Results of aerial and surface ozone measurements during the second half of 1977
[SONDERBEOB-36] N79-24591

TACKINESS
Polyimide prepreg material having improved tack retention --- polyimide-graphite fiber composites
[NASA-CASE-LEW-12933-1] N79-24061

TAIL ASSEMBLIES
Fail-safe optimal design of structures with substructuring
[AD-A065936] N79-23950

TARGET RECOGNITION
Optimum frequencies for aircraft classification
[AD-A065697] N79-24220
Considerations concerning detection of non-cooperative illuminated targets
[REPT-2-78] N79-24245

TASK COMPLEXITY
Analytical methods for biotechnological design of man machine systems: Work on system ergonomy
[FB-28] N79-24315

TEARING
Collisionless tearing instabilities
[IPPJ-370] N79-24834

TECHNOLOGY ASSESSMENT
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
Overview of helicopter ice protection system developments N79-23919
Five year plan for space test program
[AD-A065866] N79-23989
Status of materials characterization studies N79-24030
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462
Thermal power systems, point-focusing distributed receiver technology project. Volume 2: Detailed report
[NASA-CR-158534] N79-24464
Impact of solar energy on rural housing
[GPO-31-641] N79-24467
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511
Environmental development plan for transportation energy conservation. FY 1979 update
[ANL/EES-TM-33] N79-24899

TECHNOLOGY UTILIZATION
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999
Photoacoustic spectroscopy: Its application to the study of solid materials N79-24081
Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202
Research at Sandia Laboratories for Solar Thermal Large Power Systems Program
[SAND-78-8051] N79-24510
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511
High resolution electron microscopy of sulfides N79-24863
Production, utilization of computer technology in national economy N79-24947

TEFLON [TRADEMARK]
Area scaling investigations of charging phenomena --- discharge pulse characteristics of Teflon thermal control tape N79-24032
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control N79-24040

TELECOMMUNICATION
The impact of telecommunication on transportation demand through the year 2000
[PB-290833/3] N79-24246
Developing a domestic common carrier telecommunications policy: What are the issues
[PB-290787/1] N79-24249
Communications technology forecast
[PB-292697/0] N79-24252
Relationships between the performance of time/frequency standards and navigation/communication systems N79-24734

TELEMETRY
Polish Interkosmos participation described N79-23991

TELEVISION SYSTEMS
Automatic target hand-off for non-compatible imaging systems
[AD-A065525] N79-24222
TELLURIDES
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions
N79-24855
TELLURIUM
Factors influencing Seebeck effect of thin tellurium films
N79-24860
TEMPERATURE
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087
Temperature dependence of the velocity of ultrasound in mammalian tissue
N79-24767
TEMPERATURE CONTROL
Feasibility study of the application of self-tuning controllers to chemical batch reactors --- temperature control
[OUEL-1248/78] N79-24326
TEMPERATURE DISTRIBUTION
On the mathematical formulation of the first principle of thermodynamics for non-uniform temperature processes
[OUEL-1251/78] N79-24887
TEMPERATURE EFFECTS
Influence of thermal disorder on electronic properties of solids --- direct current conductivity and optical properties
N79-24872
TEMPERATURE GRADIENTS
An investigation of effects associated with thermal counterflow in rotating superfluid helium
N79-24869
TEMPERATURE INVERSIONS
Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963
A primitive equation spectral model for the study of stratospheric sudden warmings
N79-24546
TEMPERATURE MEASUREMENT
Inflight fuel tank temperature survey data
[NASA-CR-159569] N79-23940
TEMPERATURE PROFILES
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer
N79-24928
TENSILE STRENGTH
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Evaluating strength and ductility of irradiated zircaloy, task 5
[PB-291511/4] N79-24142
Large deflection response of elastic/visco-plastic beams under combined tension and bending
N79-24366
TENSILE STRESS
The fatigue of Ti6Al4V alloy in coarse and fine structural conditions under fully reverse loading as well as pulsating tension
N79-24119
TERMINAL GUIDANCE
Optical pattern recognition for terminal guidance guidance
[AD-A062821] N79-23942
TERNARY SYSTEMS
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277
TERRAIN
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247
TESTS
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345
Analyzing the solution of problems involving three-dimensional geometric figures: An exploratory study
N79-24687
TEXAS
Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
TEXTBOOKS
Aerodynamics
[NASA-TT-F-765] N79-23908
THEOREM PROVING
A Nyquist type criterion for input/output stability of linear time-invariant systems
[OUEL-1240/78] N79-24724
THEORETICAL PHYSICS
Life games: Statistical, deterministic and computer approaches in physics
N79-24721
THERMAL CONDUCTIVITY
Thermal conductivity of granular aluminum
N79-24852
THERMAL CONTROL COATINGS
Area scaling investigations of charging phenomena --- discharge pulse characteristics of Teflon thermal control tape
N79-24032
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control
N79-24040
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
THERMAL EMISSION
Measurement of the thermal emission of tungsten and analysis of electron relaxation effects
N79-24866
THERMAL ENERGY
Thermoelectrochemical cycles for power and hydrogen production
[BNL-24387] N79-24491
THERMAL FATIGUE
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
THERMAL INSULATION
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
Fibrous refractory composite insulation --- shielding reusable spacecraft
[NASA-CASE-ARC-11169-1] N79-24062
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
THERMAL PLASMAS
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029
THERMAL RESISTANCE
Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167
THERMAL STRESSES
Inelastic resistance calculations with time dependent thermal and mechanical stress
[ISD-238] N79-24390
THERMIONIC EMISSION
Summary of the two year NASA program for active control of ATS-5/6 environmental charging --- with a themionic electron source and a plasma source
N79-24006
THERMOCHEMISTRY
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system
N79-24075
THERMODYNAMIC CYCLES
Thermoelectrochemical cycles for power and hydrogen production
[BNL-24387] N79-24491
THERMODYNAMIC EFFICIENCY
Comparison of three experimental methods used in determining the thermal performance of flat-plate solar collectors
N79-24434
High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513
THERMODYNAMIC EQUILIBRIUM
Steam reforming of aromatic compounds
N79-24093
Stability and amplification of shock waves
[AD-A066108] N79-24305
THERMODYNAMIC PROPERTIES
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. Appendix E: Program listing
[NASA-CR-158632] N79-24296
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. A user's manual with examples
[NASA-CR-158631] N79-24297
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
Consequences of the renormalization group for the thermodynamics of fluids near the critical point
N79-24884
THERMODYNAMICS
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system
N79-24075
Development of measurement techniques for monitoring chemical purity of materials used in digital IC processing
[PB-291427/3] N79-24199
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440
THERMOELECTRIC POWER GENERATION
Optimum combinations of cooling alternatives for stream-electric power plants, volume 2
[PB-290576/8] N79-24515
THERMOGRAVIMETRY
The potential for accidental release of carbon/graphite fibers from resin matrix composites as determined by thermogravimetric analysis
[AD-A065962] N79-24070
THERMOMECHANICAL TREATMENT
Thermomechanical calculations for massive structures using a finite element method
[ISD-234] N79-24387
THERMOPLASTIC RESINS
Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168
THERMOREGULATION
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
Transient thermoregulatory model with graphics output
[NASA-CR-160217] N79-24637
User's instructions for the 41-node thermoregulatory model [steady state version]
[NASA-CR-160220] N79-24638
The application of sensitivity analysis to models of large scale physiological systems
[NASA-CR-160228] N79-24645
THETA PINCH
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838
THICKENERS [EQUIPMENT]
Dynamics of a continuous thickener handling a compressible slurry
N79-24083
THICKNESS
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea
[AD-A066336] N79-24586
THIN FILMS
Test results for electron beam charging of flexible insulators and composites --- solar array substrates, honeycomb panels, and thin dielectric films
N79-24031
Metallic xenon
N79-24118
The effect of carbon monoxide and methane on the resistance of tin oxide thin films
N79-24256
Diffusion and heat transfer in a plane horizontal film
[REPT-77-2] N79-24309
Gravity waves and diffusion in a liquid covered by a superficial film
[REPT-77-3] N79-24310
Identification of flow type using heated thin films
[OUEL-1238/78] N79-24313
High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
A study of grating filters in thin-film optical waveguides
N79-24819
Factors influencing Seebeck effect of thin tellurium films
N79-24860
THIN WINGS
Theory of thin wing in a supersonic flow with consideration of the non-equilibrium state of excitation of oscillating degrees of freedom
[AD-A065992] N79-23928
Supersonic flow in the area of antisymmetric thin cruciform wings with supersonic leading edges in a horizontal plane, with consideration of flow separation on the edges
[AD-A065993] N79-23929
THREE DIMENSIONAL FLOW
Three-dimensional internal flows in turbomachinery. Task 1: Secondary flow in diffusing cascades
[AD-A065696] N79-23972
THRESHOLD LOGIC
Interval counts and threshold numbers of graphs
N79-24689
THRUST
Energy maneuverability display validation --- F-16 aircraft
[AFFDL-TR-78-35-VOL-1] N79-23947
TIMBER IDENTIFICATION
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
TIMBER INVENTORY
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
TIME
Introduction to systems approach
N79-24732

Composite oscillator systems for meeting user needs for time and frequency
N79-24733

A review of the US Navy's Precise Time and Time Interval [PTTI] program
N79-24743

Overview of timing/synchronization for digital communications
N79-24746

Survey of timing/synchronization of operating wideband digital communications networks
N79-24747

An Evaluation of optional timing/synchronization features to support selection of an optimum design for the DCS digital communication network
N79-24748

Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network
N79-24749

TIME DEPENDENCE
Analytical study of the time dependent spacecraft-plasma interaction
N79-24017

TIME LAG
Time delay in quantum scattering
N79-24885

TIME MEASUREMENT
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731

Precise terrestrial time: A means for improved ballistic missile guidance analysis
N79-24736

Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks
N79-24738

Time domain measurement of frequency stability: A tutorial introduction
N79-24741

A modular multiple use system for precise time and frequency measurement and distribution
N79-24742

Down to earth relativity
N79-24753

Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes [CTS] satellite
N79-24755

TEMPUS: A proposal for international time transfer and precision tracking satellite
N79-24760

Pulsar timing results from Arecibo Observatory
N79-24917

TIME OF FLIGHT SPECTROMETERS
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792

TIME OPTIMAL CONTROL
The time budget as a criterion for the workload of air traffic controllers
[MBB-UFE-1353-O] N79-23943

TIME SERIES ANALYSIS
Weak convergence of progressively censored likelihood ratio processes
N79-24712

TIME SHARING
Turbine design system
[AD-A066092] N79-23974

TIME SIGNALS
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236

Relationships between the performance of time/frequency standards and navigation/communication systems
N79-24734

Time synchronization via the transit satellite at Mizusawa
N79-24752

Submicrosecond comparisons of time standards via the Navigation Technology Satellites [NTS]
N79-24756

TIMING DEVICES
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731

Transit satellite system timing capabilities
N79-24751

TIN COMPOUNDS
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277

TIN ISOTOPES
Neutron scattering on even isotopes of tin
N79-24870

TIN OXIDES
The effect of carbon monoxide and methane on the resistance of tin oxide thin films
N79-24256

TISSUES [BIOLOGY]
An investigation of the pulse-scatter imaging technique for medical ultrasonic imaging and tissue characterization
N79-24628

Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646

Temperature dependence of the velocity of ultrasound in mammalian tissue
N79-24767

TITANIUM ALLOYS
Effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al
[AD-A066062] N79-24124

TITANIUM OXIDES
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112

TOBACCO
Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321

TOKAMAK DEVICES
Probe measurement technique in a Tokamak
[BLL-CTO/1563-[9091.9F]] N79-24831

Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832

Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835

Tokamak physics: The 70th birthday of L. A. Artsimovich [25 February 1909 to 1 March 1973]
N79-24944

TOPOGRAPHY
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411

Numerical study of the effects of complex terrain on dynamics of airflow and pollution dispersion
[CONF-790101-4] N79-24523

TORNADOES
Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615

TOROIDAL PLASMAS
Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832

ELMO Bumpy Torus
[ORNL/TM-6743] N79-24842

Influence of globalmagnetic perturbations on plasma behavior in Elmo Bumpy Torus
[ORNL/TM-6704] N79-24843

Resonant modes of a toroidal plasma in the large major radius approximation --- radiation heating
[CTH-IEFT/PP-1977-13] N79-24846

TORQUE
Contaminant identification for an electromechancal unit
[BDX-613-2116-REV] N79-24279

TORSION
Elastic-plastic torsion of prismatic bars with polygonal cross section
[ETEC-TRANS-1] N79-24384

TOUGHNESS
Critical experiments, measurements and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[PB-291190/7] N79-24405

TOWED BODIES
High speed TV-towing system for project definition study for conception and design of a deep sea towing system with two instrumented exploration instrumental bodies in a tandem configuration for close to sea floor control
[BMFT-FB-M-77-05] N79-24623

Deep ocean reception of acoustic signals emitted by a towed source
N79-24766

TOXIC HAZARDS
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102

TRACE ELEMENTS
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098

TRACKING [POSITION]
Precision controllability of the F-15 airplane
[NASA-TM-72861] N79-23979

The optimal tracking problem for nonstationary stochastic processes
[AD-A062689] N79-24700

Development of Precision Optical Path Alignment System [POPAS]
[AD-A065673] N79-24823

TRADEOFFS
Reliability trade-offs for unit production cost
[AD-A065643] N79-24360

TRAINING SIMULATORS
Contributions of platform motion to simulator training effectiveness. Study 2: Aerobatics
[AD-A064305] N79-23985

TRANSFER FUNCTIONS
Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes [CTS] satellite
N79-24755

TEMPUS: A proposal for international time transfer and precision tracking satellite
N79-24760

Method of calculating retroreflector-array transfer functions --- laser range finders
[NASA-CR-157932] N79-24821

TRANSFER OF TRAINING
Contributions of platform motion to simulator training effectiveness. Study 2: Aerobatics
[AD-A064305] N79-23985

Learning with imperfectly labeled patterns
[NASA-CR-160183] N79-24697

TRANSFORMERS
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257

TRANSIENT HEATING
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308

TRANSIENT RESPONSE
User's instructions for the Grodins' respiratory control model using the UNIVAC 1110 remote batch and demand processing
[NASA-CR-160225] N79-24635

Transient thermoregulatory model with graphics output
[NASA-CR-160217] N79-24637

Acoustic emission and propagation of elastic pulses in a plate
N79-24768

TRANSISTOR CIRCUITS
Inductorless narrow-band filter/amplifier
[NASA-CASE-GSC-12410-1] N79-24260

TRANSISTORS
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257

Transistor screening evaluation SJ6708H
[NASA-CR-161234] N79-24258

TRANSIT SATELLITES
Transit satellite system timing capabilities
N79-24751

Time synchronization via the transit satellite at Mizusawa
N79-24752

TRANSITION METALS
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds
N79-24076

Engineering implications following the attachment of catalytically active transition metal complexes onto solid supports the leaky catalyst
N79-24080

Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum
N79-24862

TRANSMITTERS
Array scanning for image transmission
[AD-A065583] N79-24825

TRANSONIC FLOW
Numerical calculation of inviscid transonic flow through rotors and fans
N79-23906

An experimental study of transonic turbulent flow separation
N79-23907

A finite element method for the computation of the transonic potential flow past airfoils
[MBB-UFE-1352-O] N79-23935

Airfoil optimization for transonic flow using the methods of finite elements and characteristics
[MBB-UFE-1362-O] N79-23937

TRANSONIC WIND TUNNELS
Model diffuser investigation for propulsion wind tunnel 16T
[AD-A065822] N79-23984

TRANSPORT PROPERTIES
Mercury orbiter transport study
[NASA-CR-158658] N79-23987

Mechanisms of particle transport and electro-kinetic phenomena in a cross flow/electrofilter
N79-24088

Improved techniques for gasifying coal
[FE-2340-7] N79-24186

Transport properties of binary mixtures of dense hard-sphere fluids
N79-24291

Diffusion limit for the transport of quasifree electrons in liquids
[AD-A065679] N79-24795

Anomalous plasma transport due to electron temperature gradient instability
[IPPJ-369] N79-24833

Collisionless tearing instabilities
[IPPJ-370] N79-24834

Low-energy particle experiment
[AD-A066150] N79-24840
TRANSPORTATION
The impact of telecommunication on transportation demand through the year 2000
[PB-290833/3] N79-24246
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
TRANSPORTATION ENERGY
Environmental development plan for transportation energy conservation. FY 1979 update
[ANL/EES-TM-33] N79-24899
TRAPEZOIDAL WINGS
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921
TRAVELING WAVE AMPLIFIERS
Magnetic bubble traveling-wave amplifier
[AD-A065512] N79-24269
TREES [PLANTS]
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
TRIETHYL COMPOUNDS
Nuclear magnetic studies of triethylborane with cobalt and nickel compounds
N79-24116
TRINITROTOLUENE
Application of foam separation to aqueous solutions of trinitrotoluene [TNT]. Part 2: Removal of organic explosives with surfactants
[AD-A066118] N79-24103
TROPICAL STORMS
Tropical cyclone strike probability forecasting
[AD-A065545] N79-24611
TROPOSPHERE
The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere
N79-24547
TUNGSTEN
Measurement of the thermal emission of tungsten and analysis of electron relaxation effects
N79-24866
TUNGSTEN ALLOYS
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
TUNING
Feasibility study of the application of self-tuning controllers to chemical batch reactors --- temperature control
[OUEL-1248/78] N79-24326
TURBINE BLADES
Measurement of resonance vibrations of turbine blades with the Elura device
[AD-A066122] N79-23976
Low-cost directionally-solidified turbine blades, volume 1
[NASA-CR-159464] N79-24121
TURBINE ENGINES
Application of electron-beam welding to aviation production --- tests of turbine engine parts welded by electron beam
N79-24940
TURBOCOMPRESSORS
Two-stage supercharger sets: Efficiency and head distribution under full- and part-load conditions
[RTS-11613] N79-24342
TURBOFAN ENGINES
Characteristics of the advanced supersonic technology AST-105-1 configured for transpacific range with Pratt and Whitney aircraft variable stream control engines
[NASA-TM-78818] N79-23888
Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969
Low-cost directionally-solidified turbine blades, volume 1
[NASA-CR-159464] N79-24121
TURBOGENERATORS
Thermal power systems, point-focusing distributed receiver technology project. Volume 2: Detailed report
[NASA-CR-158534] N79-24464
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474
TURBOJET ENGINES
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966
A turbojet-boosted two-stage-to-orbit space transportation system design study
[NASA-CR-159018] N79-23997
TURBOMACHINERY
Performance of two-stage fan with larger dampers on first-stage rotor
[NASA-TP-1399] N79-23967
Three-dimensional internal flows in turbomachinery. Task 1: Secondary flow in diffusing cascades
[AD-A065696] N79-23972
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings
[AD-A065554] N79-24355
TURBULENCE
Effects of changes in upwind surface characteristics of mean wind speed and turbulence near a coastline
[BNL-25178] N79-24616
TURBULENT BOUNDARY LAYER
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920
Turbulent boundary layer structure and drag reduction
[AD-A065667] N79-24303
TURBULENT FLOW
An experimental study of transonic turbulent flow separation
N79-23907
A chemically reacting, turbulent shear layer
N79-24286
The structure of turbulent velocity fields
[AD-A065666] N79-24304
TWO DIMENSIONAL BODIES
Viscous effects on cavitation inception on a two dimensional cylinder
[OUEL-1225/78] N79-24312
A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems
N79-24553
TWO DIMENSIONAL FLOW
Numerical calculations of periodic gravity-capillary waves
N79-24287
Numerical solution of Navier-Stokes equations for wide range of two dimensional incompressible internal flow problems using boundary-fitted curvilinear coordinates
N79-24290

U

U.S.S.R.
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory --- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
U.S.S.R. SPACE PROGRAM
Experiments of USSR-CSSR cosmic flight described
N79-24939
ULTRASONIC LIGHT MODULATION
Diversion and modulation of optical energy in graded index multimode fiber optics
[REPT-77-213/R] N79-24822
ULTRASONIC RADIATION
Temperature dependence of the velocity of ultrasound in mammalian tissue
N79-24767
ULTRASONIC TESTS
Improved ultrasonic nondestructive testing of pressure vessels
[NUREG-CR-0581] N79-24361
An investigation of the pulse-scatter imaging technique for medical ultrasonic imaging and tissue characterization
N79-24628
ULTRASONICS
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359
ULTRAVIOLET RADIATION
Ozone/ultraviolet radiation monitoring
[PB-290594/1] N79-24539
ULTRAVIOLET SPECTROMETERS
Automation of an ultraviolet-visible spectrometer
[PB-290831/7] N79-24327
ULTRAVIOLET SPECTROSCOPY
NMR studies of synthetic polypeptide structures
N79-24146
UNDERGROUND STORAGE
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816
UNDERWATER ACOUSTICS
Deep ocean reception of acoustic signals emitted by a towed source
N79-24766
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775
Analysis of acoustical effects of receiver and source motions at short ranges in the deep ocean
[AD-A066199] N79-24776
Internal and external models of variable parameter filters
[CEPHAG-44/77] N79-24777
UNIQUENESS THEOREM
Some uniqueness problems in nonlinear L sub p-approximation
N79-24693
UNITED STATES OF AMERICA
US refining capacity: How much is enough
[PB-291437/2] N79-24192
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
UNIVERSAL TIME
Modern methods for the determination of polar motion and UT1
N79-24754
UNIVERSE
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934
UNIVERSITY PROGRAM
Program in acoustics --- aeroacoustics, aircraft noise, and noise suppression
[NASA-CR-158660] N79-24771
UNLOADING
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396
URANIUM
A radiological environs study at a fuel fabrication facility
[PB-291928/0] N79-24530
URBAN DEVELOPMENT
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
URBAN PLANNING
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904
URBAN RESEARCH
Community application of integrated energy/utility systems
[PB-290675/8] N79-24520
Research needs for community water management
[PB-291938/9] N79-24905
URBAN TRANSPORTATION
Mathematical programming methods for urban transportation networks
N79-24897
Service methods demonstration program
[PB-292008/0] N79-24898
Human factors engineering research for Cabin Taxi [CAT]
[MBB-UFE-1355-O] N79-24901
Guides for undertaking a neighborhood transportation needs assessment: Users manual
[PB-290589/1] N79-24909
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910
USER MANUALS [COMPUTER PROGRAMS]
Fuselage-mounted antenna code: User's manual
[AD-A065587] N79-24215
User's instructions for the Grodins' respiratory control model using the UNIVAC 1110 remote batch and demand processing
[NASA-CR-160225] N79-24635
Transient thermoregulatory model with graphics output
[NASA-CR-160217] N79-24637
User's instructions for the 41-node thermoregulatory model [steady state version]
[NASA-CR-160220] N79-24638
LHC-PILOT, user guide
[PB-291985/0] N79-24676
LHC-PILOT, system guide
[PB-291986/8] N79-24677
USER REQUIREMENTS
Operating manual for the RRL 8 channel data logger
[NASA-CR-158633] N79-24671

A conceptual design for an integrated data base management system for remote sensing data --- user requirements and data processing
[NASA-CR-159926] N79-24892
Guides for undertaking a neighborhood transportation needs assessment: Users manual
[PB-290589/1] N79-24909

UTILITIES
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462
Research at Sandia Laboratories for Solar Thermal Large Power Systems Program
[SAND-78-8051] N79-24510
Community application of integrated energy/utility systems
[PB-290675/8] N79-24520

V

V/STOL AIRCRAFT
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911

VACUUM TESTS
TDRSS solar array arc discharge tests --- spacecraft charging
N79-24053

VALIDITY
Spacecraft charging modeling development and validation study
N79-24051

VALVES
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174

VANADIUM COMPOUNDS
Microstructural study of V2D by X-ray measurements
N79-24854

VAPOR PHASES
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108

VAPOR PRESSURE
Vapour flows and heat conductances in ventilated cavities behind a two-dimensional cylinder. Part 1: Review of entrainment and thermodynamic effect; viscous effects on limited and developed cavitation
[OUEL-1245/78] N79-24314

VAPORIZING
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system --- for gas turbine engines
[NASA-TM-79154] N79-23965
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system
N79-24075

VAPORS
Control of volatile organic emissions from petroleum liquid storage in external floating roof tanks
[PB-290579/2] N79-24537

VARIANCE [STATISTICS]
Hypothesis testing for the common mean of two normal distributions with unknown variances when the null and alternative hypotheses are separated by a zone of indifference
N79-24713

VARIATIONAL PRINCIPLES
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396

VARIATIONS
Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622

VARIOMETERS
How accurate is NETTO
N79-23901

VECTOR ANALYSIS
Geometrically nonlinear finite element behavior using buckling mode superposition
[ISD-241] N79-24391

VECTOR SPACES
An interactive classical control design algorithm for multivariable systems in state-space form
N79-24670

VEGETATION
Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis
N79-24407
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411

VEGETATION GROWTH
Hydrocarbons and energy from plants
[LBL-8596] N79-24507

VELOCITY DISTRIBUTION
Theoretical fan velocity distortions due to inlets and nozzles --- in V/STOL aircraft
[NASA-TM-79150] N79-23911
The structure of turbulent velocity fields
[AD-A065666] N79-24304
Collisionless evolution of the auroral electron velocity distribution function
N79-24548
Direct methods for seismic profiling
[COO-2482-9] N79-24588
The distribution of maximum wind speed
[BLL-TRANS-1368-[9022.549]] N79-24601

VELOCITY MEASUREMENT
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359

VERTICAL AIR CURRENTS
How accurate is NETTO
N79-23901

VERTICAL TAKEOFF AIRCRAFT
Technical evaluation report on the 27th Guidance and Control Panel Symposium on the V/STOL Aircraft at Night and in Poor Visibility
[AGARD-AR-142] N79-23946

VERY HIGH FREQUENCIES
Standard engineering installation package. Terminal VHF Omnidirectional Range [TVOR] system an/FRN-41
[AD-A065932] N79-23941

VERY LONG BASE INTERFEROMETRY
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757

VHF OMNIRANGE NAVIGATION
Standard engineering installation package. Terminal VHF Omnidirectional Range [TVOR] system an/FRN-41
[AD-A065932] N79-23941

VIBRATION
Prediction of the angular response power spectral density of aircraft structures
[AD-A066141] N79-23956
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Coupling of electronic and vibrational motions in molecules
N79-24790
A theory of anharmonic effects in vibrational nuclei --- nonlinear equations of motion method
N79-24809

VIBRATION EFFECTS
Vibration characteristics of walls and a plate glass window representative of those of a wood-frame house
[NASA-TP-1447] N79-24372

VIBRATION ISOLATORS
Conference on Aerospace Polymeric Viscoelastic Damping Technology for 1980's
[AD-A065518] N79-24157
Development of procedures for calculating stiffness and damping of elastomers in engineering applications. Part 5: Elastomer performance limits and the design and test of an elastomer damper
[NASA-CR-159552] N79-24373
Development of Precision Optical Path Alignment System [POPAS]
[AD-A065673] N79-24823

VIBRATION MODE
Spectral and scattering inverse problems
[PM/78/1] N79-24394
Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646
Eckart frame motions and molecular vibrations --- with emphasis on angular motion and angular acceleration
N79-24789

VIBRATION PERCEPTION
Significant characteristics of social response to noise and vibration
[NASA-TM-75412] N79-24888

VIBRATIONAL SPECTRA
Simple formulae for calculating the vibrational frequencies of plates, shells and membranes
[ARL-STRUC-REPT-371] N79-24374

VIDEO EQUIPMENT
Real-time video filtering with bit-slice microprogrammable processors
N79-24207

VINYL RADICAL
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164

VIRGINIA
Solar project cost report: Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/60] N79-24483
Solar project description. Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/50] N79-24498

VISCOELASTICITY
Conference on Aerospace Polymeric Viscoelastic Damping Technology for 1980's
[AD-A065518] N79-24157

VISCOPLASTICITY
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386

VISCOSITY
The viscosity of normal and superfluid helium three
N79-24861

VISCOUS DRAG
Viscous effects on cavitation inception on a two dimensional cylinder
[OUEL-1225/78] N79-24312
Vapour flows and heat conductances in ventilated cavities behind a two-dimensional cylinder. Part 1: Review of entrainment and thermodynamic effect; viscous effects on limited and developed cavitation
[OUEL-1245/78] N79-24314

VISCOUS FLOW
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. Appendix E: Program listing
[NASA-CR-158632] N79-24296
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. A user's manual with examples
[NASA-CR-158631] N79-24297

VISIBILITY
A method for forecasting flight visibility in bad weather
[BLL-TRANS-1394-[9022.549]] N79-24605

VISUAL FLIGHT
A method for forecasting flight visibility in bad weather
[BLL-TRANS-1394-[9022.549]] N79-24605

VOICE COMMUNICATION
Nap-of-the-earth communication program for US Army helicopters
[AD-A063089] N79-24232
Priority loss systems: Unequal holding times
[AD-A066245] N79-24239

VOLUME
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087

VOLUMETRIC ANALYSIS
Phase equilibrium and volumetric properties of coal-derived fluids
[FE-2278-9] N79-24179

VORTEX BREAKDOWN
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921

VORTEX GENERATORS
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser --- for boundary layer control
[NASA-TM-79171] N79-23920

VORTICES
Aircraft wake vortices. A bibliography with abstracts
[NTIS/PS-79/0166/3] N79-23939
Rotational flows in electrically conducting and non-conducting fluids
N79-24289
The 1.11 new considerations on the development of vortex ports --- for small capacity direct injection engine
[BLL-RTS-11759] N79-24347

VOYAGER PROJECT
Electrostatic discharge properties of selected Voyager spacecraft materials
N79-24039

VULNERABILITY
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951

W

WAFERS
Silicon-on-ceramic process: Silicon sheet growth and device development for the large-area silicon sheet and cell development tasks of the low-cost solar array project
[NASA-CR-158669] N79-24453
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459

WASHINGTON
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411

Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
WASTE DISPOSAL
Land application studies of industrial waste oils and solvents
[DP-MS-78-55] N79-24524
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536
Radioactive waste disposal: A comparison of alternative nuclear fuel cycles
N79-24812
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816
Hazardous waste management problems will not be effective: Greater efforts are needed --- compliance with the Resource Conservation and Recovery Act
[PB-291622/9] N79-24907
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908
Report to the Congress on ocean dumping research
[PB-292791/1] N79-24913
WASTE ENERGY UTILIZATION
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468
Community application of integrated energy/utility systems
[PB-290675/8] N79-24520
WASTE UTILIZATION
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives --- economic analysis
N79-24813
WASTE WATER
Application of foam separation to aqueous solutions of trinitrotoluene [TNT]. Part 2: Removal of organic explosives with surfactants
[AD-A066118] N79-24103
Simulation and control of advanced wastewater treatment systems
N79-24895
WATER
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls
N79-24085
Water absorption of fluids/oils --- contamination of aircraft engine oils and inhibitors
[AD-A065915] N79-24158
WATER BALANCE
Fluid and Electrolyte Balance model [FEB]
[NASA-CR-160206] N79-24633
WATER HEATING
Heat pumps, volume 1. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0233/1] N79-24317
Heat pumps, volume 2. Citations from the Engineering Index data base --- bibliography
[NTIS/PS-79/0234/9] N79-24318
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system --- structural design criteria and system effectiveness
[NASA-CR-161191] N79-24438
Solar project description: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/50] N79-24481
Solar project description: Aratex Services, Incorporated, industrial laundry, Fresno, California
[SOLAR/2008-78/50] N79-24485
Solar project description: Iris Images, Incorported, film laboratory, Mill Valley, California
[SOLAR/2005-78/50] N79-24486
Solar project cost report. Iris Images, Incorporated, Film Laboratory, Mill Valley, California
[SOLAR/2005-78/60] N79-24494
Solar project cost report. Aratex Services, Inc., Industrial Laundry, Fresno, California
[SOLAR/2008-78/60] N79-24495
SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
WATER MANAGEMENT
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429
Research needs for community water management
[PB-291938/9] N79-24905
WATER POLLUTION
Identification of organic compounds in industrial effluent discharges
[PB-291900/9] N79-24111
Methodologies of examining pollution from urban runoff
[PB-290595/8] N79-24427
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536
The economic impact analysis of effluent standards for total dissolved solids
[PB-290916/6] N79-24541
Role of inorganic carbon availability in the formation of nuisance blooms of blue-green algae
[PB-290716/0] N79-24542
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
Report to the Congress on ocean dumping research
[PB-292791/1] N79-24913
WATER QUALITY
Fluid sample collection and distribution system --- qualitative analysis of aqueous samples from several points
[NASA-CASE-MSC-16841-1] N79-24285
A systems procedure for land use and water quality planning in a rural watershed
N79-24406
Stream channel modification in Hawaii, part A: Statewide inventory of streams, habitat factors and associated biota
[PB-290571/9] N79-24425
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891
WATER RECLAMATION
A recycled-water sanitary waste disposal system
[PB-291740/9] N79-24914
WATER RESOURCES
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Urban water resources policy alternatives: A sociological analysis of differential perspectives
[PB-290583/4] N79-24538
WATER RUNOFF
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911
WATER TABLES
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426
WATER TEMPERATURE
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]]
N79-24600
Change of the temperature trend over the North Atlantic since 1970
[BLL-TRANS-1392-[9022.549]]
N79-24603
WATER TREATMENT
Application of foam separation to aqueous solutions of trinitrotoluene [TNT]. Part 2: Removal of organic explosives with surfactants
[AD-A066118] N79-24103
Simulation and control of advanced wastewater treatment systems
N79-24895
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation
N79-24896
Minimum variance control, estimation and simulation of nonlinear models of wastewater treatment systems
[OUEL-1214/77] N79-24902
Proceedings of the Stormwater Management Model [SWMM] User's Group Meeting
[PB-290742/6] N79-24911
WATERSHEDS
A systems procedure for land use and water quality planning in a rural watershed
N79-24406
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
WAVE AMPLIFICATION
Stability and amplification of shock waves
[AD-A066108] N79-24305
WAVE DISPERSION
Wave interaction in a beam-plasma system in the presence of dispersion and higher order nonlinear effects
[CTH-IEFT/PP-1977-15] N79-24848
WAVE INTERACTION
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
Wave interaction in a beam-plasma system in the presence of dispersion and higher order nonlinear effects
[CTH-IEFT/PP-1977-15] N79-24848
WAVE PROPAGATION
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240
Experimental laser anemometry and analysis of electromagnetic waves in moving media
N79-24328
Temperature dependence of the velocity of ultrasound in mammalian tissue
N79-24767
Acoustic emission and propagation of elastic pulses in a plate
N79-24768
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775
Propagation of ion acoustic cnoidal wave
[IPPJ-367] N79-24837
WAVEFORMS
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359
A method for waveform inversion of body-wave seismograms
N79-24558
WAVEGUIDES
GaAs electroabsorption avalanche photodiode waveguide detectors
[AD-A065986] N79-24824
WEAPONS
Establishment of a process for creep forging aluminum alloy weapon components
[AD-A062491] N79-24128
WEAPONS DEVELOPMENT
Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957
WEAR
Diagnostics of wear in aeronautical systems
[NASA-TM-79185] N79-24350
Hydrodynamic lubrication with wear and asperity contact in mechanical face seals
[AD-A065924] N79-24357
WEAR TESTS
Aircraft engine oil analysis by neutron activation techniques
[AD-A066202] N79-24169
WEATHER
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-[9022.549]]
N79-24602
WEATHER FORECASTING
Change of the temperature trend over the North Atlantic since 1970
[BLL-TRANS-1392-[9022.549]]
N79-24603
A method for forecasting flight visibility in bad weather
[BLL-TRANS-1394-[9022.549]]
N79-24605
Tropical cyclone strike probability forecasting
[AD-A065545] N79-24611
Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615
WEDGES
Diffraction by a dielectric wedge
[AD-A065699] N79-24762
WEIGHT REDUCTION
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971
WEIGHTLESSNESS
Validation of a model for investigating red cell mass changes during weightlessness
[NASA-CR-160188] N79-24634
WELD STRENGTH
Predicting stress corrosion cracking in welded steel based on residual stress measurements
[BDX-613-2099-REV] N79-24131
WELD TESTS
Application of electron-beam welding to aviation production --- tests of turbine engine parts welded by electron beam
N79-24940
WELDED JOINTS
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 1
[LBF-TB-111-VOL-1] N79-24400
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 2
[LFB-TB-112-VOL-2] N79-24401
Application of electron-beam welding to aviation production --- tests of turbine engine parts welded by electron beam
N79-24940
WHEAT
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Ex-

periment and the outlook for a satellite crop inventory -u- Great Plains Corridor [North America], Canada, U.S.S.R., Brazil, China, India, and Australia
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414
Research in remote sensing of agriculture, earth resources, and man's environment --- Arizona
[E79-10195] N79-24415
WILDLIFE
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
WIND [METEOROLOGY]
A simple method for an objective, local forecast of gusts
[BLL-TRANS-1393-[9022.549]] N79-24604
Wind engineering research digest, volume 3, 1978 --- a bibliography of ongoing research projects
[PB-290694/9] N79-24621
WIND EFFECTS
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]] N79-24600
WIND PROFILES
Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609
Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610
WIND TUNNEL MODELS
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319
WIND TUNNEL TESTS
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control N79-23895
An investigation of a full-scale rotor with four blade tip planform shapes --- in Ames Research Center 40 by 80 Foot Wind Tunnel
[NASA-TM-78580] N79-23922
Hardened RV development program. Phase 4: Vehicle recovery technology wind tunnel tests
[AD-A066095] N79-23930
WIND TUNNELS
An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982
WIND VELOCITY
The distribution of maximum wind speed
[BLL-TRANS-1368-[9022.549]] N79-24601
Effects of changes in upwind surface characteristics of mean wind speed and turbulence near a coastline
[BNL-25178] N79-24616
An analytical approach to wind velocity gust factors
[OUEL-1241/78] N79-24620
WINDOWS [APERTURES]
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
WING PLANFORMS
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923
WING PROFILES
Wing shape optimization for maximum cross-country speed, with mathematical programming N79-23899
WINGS
The effect of disturbance on a wing N79-23893
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control N79-23895
Numerical optimization techniques for bound circulation distribution for minimum induced drag of nonplanar wings: Basic formulations
[NASA-CR-3154] N79-23924
WIRE CLOTH
Some experimental observations of the flow through gauze screens
[ATN-7804] N79-24300
WISCONSIN
Stratification and sample selection for multicrop experiments --- Arkansas, Kentucky, Michigan, Missouri, Mississippi, Ohio, Wisconsin, Illinois, Indiana, Minnesota, Iowa, Louisiana, Nebraska, South Dakota, and North Dakota
[E79-10190] N79-24410
WOOD
Test and evaluation of split ring shear connectors in laminated wood and laminated wood bolts
[AD-A066323] N79-24381
WOODEN STRUCTURES
Vibration characteristics of walls and a plate glass window representative of those of a wood-frame house
[NASA-TP-1447] N79-24372
WORKLOADS [PSYCHOPHYSIOLOGY]
The time budget as a criterion for the workload of air traffic controllers
[MBB-UFE-1353-O] N79-23943
WYOMING
In situ coal gasification modeling
[UCRL-82269] N79-24479

X

X RAY ANALYSIS
Microstructural study of V2D by X-ray measurements N79-24854
X RAY APPARATUS
A combined spacecraft charging and pulsed X-ray simulation facility N79-24054
X RAY DIFFRACTION
Structure analyses of organic compounds using X-ray crystallographic techniques N79-24851
X RAY IRRADIATION
Skynet satellite electron precharging experiments N79-24037
XENON
Metallic xenon N79-24118

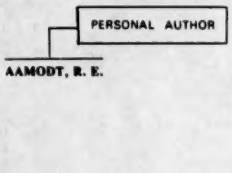
Y

YAG LASERS
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221
Nd:YAG development for spaceborne laser ranging system
[NASA-CR-159932] N79-24329
YAW
An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982
YIELD
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective --- United States of America, Canada, Brazil, Argentina, U.S.S.R., China, India, and Australia
[E79-10194] N79-24414

Z

ZINC OXIDES
Broadband zinc oxide transducer for integrated optics
[AD-A062851] N79-24827
ZINC SULFIDES
Production of cracks in ZnS under a uniform dynamic stress field
[AD-A065941] N79-24159
ZIRCALOYS [TRADEMARK]
Evaluating strength and ductility of irradiated zircaloy, task 5
[PB-291511/4] N79-24142
ZIRCONIUM
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system N79-24075

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABBUNDI, R. N79-24764
ABDULAAL, M. F. S. N79-24897
ADAMO, R. C. N79-24009
N79-24055
N79-24056
N79-24057
ADAMS, R. C. N79-24534
ADAMS, R. I. N79-23919
ADAMS, W. C., JR. N79-24825
ADAMS, W. S. N79-24742
ADOLPH, H. G. N79-24164
AGRAWAL, A. K. N79-24132
AHLUWALIA, R. K. N79-24508
AHRENS, F. W. N79-24508
AKHLAGHI, M. R. A. N79-24693
AKSENOV, Y. P. N79-23928
ALARIO, J. N79-24298
ALBERT, J. N79-23909
ALBUS, J. S. N79-24658
ALLAG, O. N79-24106
ALLCOCK, H. R. N79-24165
ALLEN, R. T. N79-24743
ALLER, C. N79-24649
ALLISON, L. J. N79-24421
ALTAN, T. N79-24123
ALTMANN, H. W. N79-24080
AMLICKE, B. B. N79-23905
ANDERLE, R. J. N79-24750
ANDERSON, D. N79-24339
N79-24340
N79-24844
ANDERSON, R. J. N79-24533
ANDRISANI, D., II N79-23978
ANISKIN, L. V. N79-24601
ARGYRIS, J. H. N79-24308
N79-24385
N79-24386
N79-24387
N79-24392
N79-24393
N79-24702
ARKERYD, L. N79-24703
ARMALY, B. F. N79-24791
ARMSTRONG, B. R. N79-24594
ARMSTRONG, J. A. N79-24543
ARMSTRONG, R. L. N79-24594
ARMSTRONG, S. A. N79-24325
ARNOLD, D. A. N79-24821
ARNOLD, F. E. N79-24167
N79-24168
ARON, P. R. N79-24032
ARORA, J. S. N79-23949
N79-23950
N79-24378
ARSENAULT, D. R. N79-24223
ASHKENAZI, M. N79-24684
ASHWORTH, G. R. N79-24654
ATKINSON, R. S. N79-24683

B

BABER, H. T., JR. N79-23888
BADACHHAPE, R. B. N79-24099
BADER, T. R. N79-24825
BAGHDADI, A. N79-24473
BAHAR, E. N79-24228
BAILEY, W. F. N79-24798
BAILY, P. N79-24333
BAIN, R. L. N79-24185
BAKER, F. E., JR. N79-24266
BAKER, R. D. N79-24801
BAKSHIYAN, B. T. N79-24694
BALDWIN, R. M. N79-24185
BALMAIN, K. G. N79-24041
BAN-YA, S. N79-24120
BANERJEE, P. N79-24758
BANKS, B. A. N79-24154
BARENGOLTZ, J. B. N79-24039
BARNA, G. J. N79-24444
BARR, R. S. N79-24679
BARSOUM, M. W. N79-24470
BARTHOLOMEW, B. J. N79-24817
BARTLETT, R. O. N79-24006
BARTON, J. L. N79-24258
BASU, A. N79-24819
BASU, S. N79-24577
N79-24577
BATES, C. W., JR. N79-24273
BAUER, M. E. N79-24410
BAXTER, N. H. N79-24685
BEERS, B. L. N79-24018
N79-24055
BEERS, J. N79-24200
BEHEIM, M. A. N79-23914
BEHRIN, E. N79-24503
BEKOWIES, P. J. N79-24531
N79-24532
BELIE, R. G. N79-24367
BELK, J. P. N79-24188
BELLAN, J. N79-24173
BELLET, J. P. N79-24883
BELLEW, W. F. N79-24668
BELLUCCI, R. N79-24614
BENHAM, P. P. N79-24375
BENREUVEN, M. N79-24173
BEREZIN, A. S. N79-24943
BERGER, H. N79-24362
BERGQVIST, B. N79-24502
BERKOPEC, F. D. N79-24031
N79-24033
BERNARD, M. J., III N79-24899
BERNER, W. N79-24128
BERNSTEIN, P. A. N79-24252
BERRY, L. A. N79-24248
N79-24842
N79-24129
BERSTEIN, I. M. N79-23895
BERTELSEN, W. D. N79-24737
BESSON, R. S. N79-24686
BETOUNES, D. E. N79-24876
BHARAT, R. N79-24128
BHATTACHARYYA, S. N79-24871
BHUSHAN, M. N79-24843
BIENIOSEK, F. M. N79-24443
BIFANO, W. J. N79-23973
BILL, F. A. N79-24322
BIRGER, Y. M. N79-24128
BIRLA, N. C. N79-24909
BISH, R. L. N79-24910
N79-24219
BLACK, L. M. N79-23912
BLAHA, B. J. N79-24472
BLAIS, P. D. N79-24709
BLAISDELL, E. A., JR. N79-24687
BLAKE, J. A. N79-24647
BLANKENSHIP, J. E. N79-24588
BLEISTEIN, N. N79-24815
BLESER, E. J. N79-24449
BLOCHER, J. M., JR. N79-23968
BOBULA, G. A. N79-23969
N79-24234
BOERSMA, J. N79-24722
BOLAND, J. S. N79-24302
BOLZ, C. W., JR. N79-24339
BONNEDAL, M. N79-24846
BOO, J. N79-24187
BOSMA, S. J. N79-24043
BOSS, C. B. N79-24796
BOSSLER, R. B., JR. N79-23973
BOUCHERON, P. H. N79-24488
BOULANGER, J. S. N79-24755
BOURIANOFF, G. I. N79-24814
BOWDEN, J. N. N79-24178
BOYKIN, R. G. N79-24181
BOZUNG, H. G. N79-24342
BRADLEY, D. B. N79-24748
BRAITHWAITE, W. M. N79-23963
BRANDENBURG, W. N79-24109
BRANTLEY, J. W. N79-23970
BRASSELL, B. B. N79-23954
N79-23955
BRAUSER, K. N79-24901
BREIDENTHAL, R. E., JR. N79-24286
BRENNER, P. N79-24729
BREWER, D. H. N79-24131
BRINKMAN, D. W. N79-24178
BRISBIN, D. J. N79-24788
BROADWAY, J. A. N79-24530
BROOK, C. A. H. N79-24725
BROOKS, K. N79-24424
BROOKS, R. L. N79-24285
BROTHERS, K. C. N79-24537
BROWN, D. L. N79-23956
BROWN, J. R. N79-24162
BROWN, L. D. N79-24589
BROWN, R. S. N79-24174
BROWN, S. H. N79-24266
BROWNING, M. F. N79-24449
BRUM, R. D. N79-24377
BRUMMER, S. B. N79-24518
BRYANT, H. J. N79-24647
BUCHANAN, P. N79-24187
BUCKLEY, K. F. N79-24874
BUISSON, J. N79-24756
BUNKER, E. M. N79-24673
BUNN, M. H. N79-24050
BURCHILL, R. F. N79-24417
BURGESS, E. L. N79-24511
BURKE, A. R. N79-24505
BURKE, H. K. N79-24919
BURKHART, B. R. N79-24894
BURNETT, S. W. N79-24614
BURNS, R. K. N79-24444
BURNSIDE, W. D. N79-24214
N79-24215
N79-24216
N79-24217
BURR, R. K. N79-24537
BUSH, J. R., JR. N79-24441
BUSH, R. L. N79-24742
BUSHUYEV, M. K. N79-24942
BUSSION, J. N79-24757
BUTHOD, A. P. N79-24106
BUTLER, T. W. N79-24360
BYRANT, B. N79-24180
BYRNE, G. N79-24421

C

CABASSO, I. C. N79-24110
CAIN, D. E. N79-24488
CAIN, J. B., III N79-24748
CAIRO, F. J. N79-24431
CALDWELL, R. N79-24259
CALVIN, M. N79-24507
CAMPBELL, R. B. N79-24469
N79-24472
CAMPBELL, R. R. N79-24145
CANEY, R. D. N79-23974
CANN, G. L. N79-24060
CANNADAY, S. S. N79-24039
CAPDEQUI-PEYRANERE, M. N79-24803
CARAM, H. S. N79-24176
CARDEN, H. D. N79-24372
CARRIGAN, B. N79-23959
N79-23960
N79-23961
N79-23962
CARTER, W. S. N79-24754
CARY, J. R. N79-24727
CASSIDY, J. J. N79-24011
N79-24012

CASTLE, R. W. N79-24522
CAVENY, L. H. N79-24173
CENA, R. J. N79-24479
CERANOGLU, A. N. N79-24768
CESAITIS, J. V. N79-24251
CHAKRABORTY, B. N79-24872
CHAMPAGNE, F. H. N79-24304
CHAN, A. H. C. N79-24148
CHAN, L. Y. N79-24551
CHANG, J. S. N79-24015
CHANG, L. A. N79-24553
CHANG, W. S. C. N79-24824
CHAPMAN, G. I. N79-24676
N79-24677
CHAPMAN, P. W. N79-24453
CHECHENIN, N. G. N79-24945
CHELLEHMALZADEH, M. A. N79-24781
CHEN, J. N79-24808
CHEN, K. L. N79-24176
CHEN, R. T. N. N79-23977
CHEN, S. S. N79-24289
CHENG, L. Y. N79-24166
CHERNOFF, R. C. N79-24210
CHIAO, S. H. N79-24272
CHIK, H. H. N79-24508
CHILDS, I. N79-24320
CHINNERY, M. A. N79-24578
CHITTINENI, C. B. N79-24697
CHIU, A. N. L. N79-24621
CHIU, Y. T. N79-24572
CHODOROW, M. N79-24271
CHOU, C. N79-24818
CHOU, E. J. N79-24103
CHOW, J. H. N79-24701
CHRISTIANSEN, C. C. N79-24423
CHRISTIE, K. O. N79-24177
CHU, C. T. W. N79-24165
CHUANG, C. C. N79-24111
CHUANG, D. T. P. N79-24710
CHURCHILL, R. J. N79-24040
CHWIEROTH, F. S. N79-24775
CICONE, R. N79-24416
CIPOLLA, J. W., JR. N79-24017
CLARK, A. E. N79-24764
CLARK, D. A. N79-24782
CLARK, H. T. N79-24163
CLARK, W. S. N79-24598
CLARKE, D. W. N79-24706
CLAUER, A. H. N79-24123
CLAY, F. A. N79-24279
COHEN, A. S. N79-24579
COHEN, H. A. N79-24009
COHEN, J. K. N79-24588
COLESTOCK, D. L. N79-24843
COOK, G. N79-24769
COOKE, D. N79-24028
COOPER, J. F. N79-24503
COOPER, L. P. N79-23965
COPELAND, R. L. N79-24029
CORNWALL, J. M. N79-24572
COSTAIN, C. C. N79-24755
COSTOGUE, E. N. N79-24431
COTHERN, C. R. N79-24597
COTTINGHAM, J. G. N79-24307
COX, J. E. N79-24738
CRABTREE, G. E. N79-24279
CRAIN, O. L. N79-24522
CRAVEN, S. M. N79-24107
CRAWFORD, D. W. N79-24646
CRAWFORD, J. P. N79-24806
CRESSWELL, S. A. N79-24736
CRIST, E. N79-24416
CROAKIN, C. N79-24200
CROCE, M. N79-24103
CROLEY, T. E. N79-24515
CROWLEY, D. P. N79-24104
CRUZRAMOS, C. A. N79-24150
CUNNAN, W. S. N79-23967
CUNNINGHAM, R. M. N79-23915
CURKENDALL, D. W. N79-24759
CURRIN, B. L. N79-24077

D

DAAMS, H. N79-24755
DAHL, P. F. N79-24815
DALLY, J. W. N79-24141
DAMPIER, F. W. N79-24518
DANA, W. J. N79-24654
DAO, K. C. N79-24159
DARLOW, M. S. N79-24373
DAS, M. B. N79-24199
DAS, P. N79-24223
N79-24876
DASH, J. B. N79-24678
DAUBERT, J. N79-24429
DAVID, L. J. N79-23984
DAVIS, B. J. N79-24410
DAVIS, J. B. N79-24472
DAVIS, L. L. N79-24571
DAVIS, W. W. N79-24278
DAVITIAN, H. N79-24509
DEANGELO, L. N79-24166
DEBOI, H. H. N79-24352
DEDERICH, D. J. N79-24745
DEJARNETTE, F. R. N79-23921
DELUIGS, P. N79-24061
DEMAREE, R. G. N79-24718
DEMINCO, N. N79-24219
DETTMER, J. W. N79-24841
DEVILLEDARY, C. N79-24240
DEYOUNG, J. N79-23923
DICKERHOOF, D. W. N79-24185
DICKSON, C. R. N79-24585
DICRISTINA, V. N79-23926
DIETZ, E. J. N79-24711
DILOUIS, J. M. N79-24427
DIONNE, G. F. N79-24763
DISSINGER, G. R. N79-24176
DIXON, M. N79-24361
DOAK, R. B. N79-24330
DODDS, D. E. N79-24353
DOERING, B. N79-24315
DOLLINGER, G. L. N79-24554
DOLTSINIS, J. S. N79-24386
N79-24390
DOMITZ, S. N79-24025
DONGES, E. N79-24657
DONOUGHE, P. N79-23999
DOUGHERTY, L. S. N79-24828
DOWNING, R. G. N79-24431
DOYLE, B. L. N79-24878
DOZIER, A. W. N79-24774
DREXL, K. W. N79-24346
DRUMMOND, W. E. N79-24814
DUCATI, A. C. N79-24060
DUDECK, M. N79-24309
N79-24310
DUDLEY, V. E. N79-24512
DUFFY, C. J. N79-24426
DULIKRAVICH, D. S. N79-23906
DUNHAM, D. W. N79-23996
DUNNE, P. C. N79-24392
N79-24393
DUPONT, S. N79-23901
DURRETT, J. C. N79-24002
DYER, R. M. N79-24581
DYKA, C. T. N79-24363

E

EAGLES, A. E. N79-24034
EATON, H. E., JR. N79-24081
EBERLE, A. N79-23935
N79-23937
EDSON, R. N79-23948
EHRSAM, E. E. N79-24736
EISCHER, M. C. N79-24744
ELEMO, R. O. N79-24409
ELLEMAN, D. D. N79-24197
ELLIS, R. J. N79-24473
ELLISON, J. E. N79-24264
ELSZTEIN, P. N79-23991
ELYASBERG, P. Y. N79-24656
ELZINGA, M. N79-24361
EMMONS, D. A. N79-24735
ENDERS, J. H. N79-23913
ENDO, S. N79-24370
ENEVOLDSON, E. K. N79-24654
ENGLISH, T. C. N79-24739
EPPLER, R. N79-23893
N79-23896
ERB, R. B. N79-24413
N79-24414
ERICSEN, T. S. N79-24276
ERICSSON, L. E. N79-23981
ERMOLAEVA, T. A. N79-24112
N79-24144
ESS, A. N79-24666
ESTRADA-VAZQUEZ, H. N79-24876
EUSEPI, M. N79-24356

F

FACE, S. H. N79-24054
FAELTHAMMAR, C. G. N79-24020
FAHLESON, U. V. N79-24020
FARGETTON, H. N79-24243
FARNEY, G. K. N79-24262
FARTHING, W. E. N79-24540
FARUKHI, S. N79-24469
FAULKNER, J. N79-24844
FEINGOLD, H. N79-23987
FEINSTEIN, R. N79-24647
FELDSTEIN, C. N79-24646
FENKER, H. C. N79-24807
FIELD, E. C. N79-24230
FINE, M. E. N79-24127
FINSOD, T. D. N79-24751
FINZI, J. N79-24333
FISCHBEIN, W. N79-24027
FISCHER, M. J. N79-24239
FITZJERRELL, D. G. N79-24633
N79-24641
FLANAGAN, R. P. N79-24766
FLESSELLES, J. N79-24321
FOGDALL, L. B. N79-24039
FONG, F. K. N79-24292
FONT, J. N79-24096
FONTAINE, H. N79-24777
FORD, D. G. N79-24371
FORD, J. R. N79-24187
FORD, W. H., JR. N79-24676
N79-24677
FORSYTH, G. F. N79-23982
FOSTER, E. L., JR. N79-24799
FOURNEY, W. L. N79-24141
FOX, M. K. N79-23947
FRAASS, R. G. N79-24267
FRANCAVILLA, T. L. N79-24277
FRATTESI, G. N79-24604
FREDERICK, J. R. N79-24361
FREDERICKSON, A. R. N79-24035
FREEMAN, J. W. N79-24028
FRIEDLANDER, A. L. N79-23987
FRIEDMAN, D. U. N79-24237
FRIEDMAN, E. N79-24419
FRINK, N. T. N79-23921
FRITSCH, J. N79-24592
FROMME, D. A. N79-24037
FUJII, M. N79-24121
FUJIMURA, T. N79-24440
FUJITA, J. N79-24835
N79-24839
FURUKAWA, S. N79-24642
N79-24644
FUWA, T. N79-24120

G

GAGLIARDI, J. A. N79-24160
GALIN, L. A. N79-24384
GALITSYN, A. A. N79-24942
GALLAGHER, R. R. N79-24639
N79-24643
GALLAGHER, W. J. N79-24142
GANAPATHY, K. N79-24361
GARDINER, J. C. N79-24712
GARDNER, C. S. N79-24671
GARG, S. C. N79-24758
GARNIS, E. A. N79-24161
GARRETT, H. B. N79-24003
N79-24005
N79-24019
GARY, J. H. N79-24185
GATES, R. K. N79-23958
GAVRILOVA, L. A. N79-24112
GAY, C. N79-24928
GAYDUKOV, V. Y. N79-24565
GEHLEN, P. C. N79-24382
N79-24405
GELHAR, L. W. N79-24426
GELLERT, E. P. N79-24162
GENDRIN, R. N79-24240
GERLACH-MEYER, U. N79-24134
GIANNAKIDIS, D. N79-24146
GIAQUINTA, A. R. N79-24515
GIBBINS, M. N. N79-24067
GILL, J. T. N79-24107
GIRARD, T. A. N79-24783
GLANGEAUD, F. N79-24240
GLOECKLER, G. N79-24792
N79-24935
GODARD, R. N79-24015
N79-24016
GOLDEN, J. O. N79-24185
GOLDHAMMER, L. N79-24261
GOLDSTEIN, H. E. N79-24062
GONFALONE, A. N79-24020
GOREY, J. C. N79-24524
GOULD, C. M. N79-24873
GOULD, R. K. N79-24448
GOVIL, A. K. N79-23949
N79-23950
GOVIND, S. N79-24204
GRAFF, R. A. N79-24186
GRAFINGER, A. N79-24919
GRAJEK, M. A. N79-24049
GRANAT, L. N79-24525
GRANSDEN, S. N79-24099
GREEGOR, R. B., II N79-24039
GREENWAY, M. E. N79-24620
GREER, E. D. N79-24214
GREGORY, R. O. N79-24824
GRIER, N. T. N79-24022
GRIGG, N. S. N79-24903
N79-24904
GRIGORYEV, Y. N. N79-23928
GROENER, L. S. N79-23930
GRONCKI, P. J. N79-24504
GROSS, G. W. N79-24426
GROSSMAN, G. M. N79-24538
GROUNDS, D. J. N79-24637
GRUENTHALER, K. H. N79-24065
GRUNBERG, G. N79-24803
GRUNG, B. L. N79-24453
GUBSER, D. U. N79-24277
N79-24738
GUENTHER, D. N79-24324
GULLAHORN, G. E. N79-24917
GUPTA, P. N79-24356

GUPTA, Y. M. N79-24159
GURSKI, G. S. N79-23999
GURTLER, R. W. N79-24473
GUTIERREZ, G. N79-24627

H

HAAKINSON, E. J. N79-24247
N79-24248
HABER, F. N79-24346
HABERCOM, G. E., JR. N79-23939
N79-24201
N79-24319
N79-24403
N79-24404
N79-24780
HACKING, K. N79-24320
HAECKER, M. A. N79-24598
HAFFNER, J. W. N79-24048
HAGAN, M. P. N79-24577
N79-24668
HAGN, G. H. N79-24232
HAHN, G. T. N79-24382
N79-24405
HAILBACH, E. N79-24400
HALE, M. G. N79-23984
HAMANO, N. N79-24361
HAMED, A. A. N79-23972
HAMILTON, J. C. N79-24853
HANNA, C. N79-24241
HANSON, B. E. N79-24115
HANSON, D. W. N79-24755
HANSON, P. W. N79-23889
HARA, J. N79-24752
HARPER, D. L. N79-24598
HARPER, L. L. N79-24329
HARRIS, C. J. N79-24724
N79-24902
HARRIS, P. N79-24305
HARRISON, E. A. N79-24650
HARTLEY, A. K. N79-24675
HARTMAN, H. F. N79-24188
HARTMANN, P. N79-24623
HARTNETT, M. J. N79-24364
HASLAM-JONES, T. F. N79-23938
HASSEL, D. N79-24346
HATER, J. J. N79-24718
HAUG, E. J. N79-23949
N79-23950
HAUGE, R. H. N79-24099
HAWK, J. D. N79-23911
HAYNES, M. P. N79-24922
HAZELTON, R. C. N79-24040
HEAPS, J. D. N79-24453
HEARN, N. D. N79-24655
HEATON, T. H. N79-24557
HEDBERG, F. L. N79-24167
HEDMAN, B. A. N79-24688
HEDRICK, C. L. N79-24842
HEINE, D. N79-24097
HEINRICH, W. N79-24065
HEJI, S. N79-24275
HELLWIG, H. N79-24734
HELWIG, G. N79-23899
HEMP, W. S. N79-24398
HENDERSON, M. L. N79-23890
HENG-CHENG, L. N79-24220
HENRY, J. A. N79-24599
HEPLER, A. K. N79-23997
HERBERT, F. N79-24607
HERZBERG, S. N79-24891
HEWITT, J. N79-24610
HEYDE, G. N79-24920
HIEFTJE, G. M. N79-24100
N79-24796
N79-24797
HILBERS, G. R. N79-24056
HILLER, R. L. N79-24903
N79-24904
HILTEN, J. S. N79-24284
HILTON, D. A. N79-24773
HINO, M. N79-24120
HINZ, K. N79-24592
HIXON, C. W. N79-24299
HIXSON, M. M. N79-24410
HO, S. V. N79-24092
HOAGLAND, R. G. N79-24382
N79-24405
HOECKER, W. H. N79-24513
HOGO, H. N79-24531
N79-24532
HOHL, F. N79-24921
HOLDER, C. H., JR. N79-24784
HOLLEMAN, G. N79-24333
HOLLENACK, W. R. N79-24181
HOLMAN, A. B. N79-24050
HOLMBERG, J. G. N79-24502
HOLMES, D. C. N79-24760
HOLMES, H. E. N79-24175
HOLMES, V. P. N79-24663
HOLST, T. L. N79-23909
HOLTON, J. R. N79-24567
HOLZT, H. P. N79-24346
HONG, C. S. N79-24820
HOOKS, H. W. N79-24181
HOPKINS, R. H. N79-24472
HOPPE, H. O. N79-24804
HOPPIN, G. S., III N79-24121
HORN, H. E. N79-24326
HORNE, R. J. N79-24586
HORVATH, R. N79-24416
HOTCHKISS, G. B. N79-24434
HOTTIER, F. N79-24108
HOTTMAN, W. E. N79-24555
HOUGH, C. L., JR. N79-24194
HOWELL, G. C. N79-23946
HSIEH, K. C. N79-24792
HSU, T. D. N79-24515
HSU, Y. H. L. N79-24852
HUBER, W. B. N79-24009
HUDGENS, C. R. N79-24505
HUFF, L. L. N79-24541
HUFFMAN, R. D. N79-24649
HUI, K. N79-24333
HUNCZAK, H. R. N79-23999
HUNDEMANN, A. S. N79-24316
N79-24317
N79-24318
N79-24430
HUNGER, H. F. N79-24264
HURD, W. J. N79-24757
HUSSEY, D. H. N79-24540
HWANG, H. C. N79-24018

I

ICHIKAWA, Y. H. N79-24837
N79-24845
ICHIMURA, K. N79-24839
IDDINGS, G. E. N79-24659
IKEGAMI, H. N79-24843
ILES, P. A. N79-24454
IMMEL, G. N79-24901
INOUYE, G. T. N79-24042
N79-24047
N79-24053
IRBY, J. H. N79-24838
IRWIN, G. R. N79-24141
ISTOMIN, V. G. N79-24565
ITO, H. N79-24833
ITO, Y. M. N79-24166

J

JACKSON, J. R. N79-24489
JACOBSON, I. D. N79-24769
JACOBSON, M. J. N79-24776
JAIN, A. K. N79-24205
N79-24236
JAIN, C. L. N79-24758
JAMES, L. A. N79-24133
JAMES, L. R. N79-24718
JAMISON, R. G. N79-24158
JANES, S. N79-24065
JANKOV, R. N79-24343
JARRELL, J. D. N79-24611
JASPER, L. J., JR. N79-24269
JASPERSE, J. R. N79-24580
JAULENT, M. N79-24072
N79-24705
JEAN, B. R. N79-24206
JECHART, E. N79-24739
JEFFERYS, W. H. N79-24925
JENKINS, J. F. N79-24474
JENSEN, S. W. N79-24785
JESCH, R. L. N79-24595
JEUNHOMME, L. N79-24822
JHANGIANI, V. B. N79-24882
JO, H. S. U. N79-24854
JOHANSON, J. N79-24577
JOHANSON, W. R. N79-24855
JOHNSEN, T. L. N79-24702
JOHNSON, B. N79-24008
JOHNSON, S. H. N79-24176
JONES, A. B. N79-24355
JONES, M. A. N79-24519
JONES, R. N79-24374
JORY, H. N79-24275
JOSS, J. N79-24602
JOURDAIN, G. N79-24778
JUNGCLAUS, G. A. N79-24111

K

KABACOFF, L. T. N79-24856
KACHEL, W. M. N79-24895
KADOMTSEV, B. B. N79-24944
KADOTA, K. N79-24835
KAHAN, A. N79-24734
KALLENBERG, O. N79-24704
N79-24720
N79-24728
KAM, A. Y. N79-24190
KAMARCHIK, P. N79-24099
KAMATH, S. N79-24261
KAMIMURA, T. N79-24833
KANABUS, E. W. N79-24834
KANNINEN, M. F. N79-24646
KANNINEN, M. W. N79-24405
KAO, K. J. N79-24382
KAPUSTKA, R. E. N79-24857
KASCHANI, D. T. N79-24441
KATANUMA, I. N79-24521
KATINOVA, L. V. N79-24834
KATZ, I. N79-24064
KAUTH, R. N79-24011
KAWAHATA, K. N79-24416
KAYS, J. L. N79-24839
KAZ, I. N79-24776
KEITH, J. S. N79-24012
KENDALL, D. N79-23974
KENDRICK, J. D. N79-24898
KERENS, G. N79-24682
KHEMTHONG, S. N79-23983
KILIAN, H. J. N79-24454
KILLUS, J. P. N79-24102
N79-24531
N79-24532
KIM, J. T. N79-24091
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KITZIS, J. L. N79-24213
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KLEIN, S. N79-24713
KLEINBERG, L. L. N79-24260
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KNEBA, M. N79-24805
KNECHTLI, R. C. N79-24261
KNEPP, D. L. N79-24227
KNICK, E. B., JR. N79-24825
KOBAYASHI, T. N79-24141
KOCH, V. R. N79-24518
KOCMOND, W. C. N79-24533
KODAVASAL, A. S. N79-24090
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KOGA, T. N79-24370
KOIDE, F. N79-24745
KOLECKI, J. C. N79-24025
KOLESAR, R. R. N79-24218
KOLOMEETS, A. I. N79-24112
KOMATSU, G. K. N79-24042
KOMP, R. J. N79-24514
KONNO, K. N79-24837
KONRADI, A. N79-24004
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KOPROVA, L. I. N79-24564
KORENOWSKI, G. M. N79-24078
KORFF, S. A. N79-24631
KOROSTELEV, Y. A. N79-23976
KOROSTELIN, I. N79-24947
KRAEHLING, H. N79-24097
KRASNOV, N. F. N79-23908
KRASOV, Y. N79-24947
KREISMAN, W. S. N79-24452
KRISHAN, S. K. N79-24093
KRIVTSOV, A. N79-24948
KRON, N. F. N79-24579
KRUGMANN, H. H. L. N79-24812
KSIENSKI, A. A. N79-24220
KUBBAT, W. J. N79-23980
KUEBBELER, K. H. N79-23993
KUEHNE, D. L. N79-24089
KUHLMAN, J. N79-23924
KULIKOV, V. N79-24630
KULKARNI, K. M. N79-24128
KULPINSKI, J. N79-24268
KUMAR, D. N79-24290
KUMAR, R. N79-24758
KUNKEL, B. A. N79-24581
KUNZE, K. R. N79-24099
KUO, C. H. A. N79-24088
KUROKAWA, T. N79-24660
KWON, T. M. N79-24739

L

LABB, H. N79-24268
LACAVA, A. N79-24186
LACINA, W. B. N79-24337
N79-24338
LACOUME, J. L. N79-24240
LAFRAMBOISE, J. G. N79-24015
N79-24016
LAHOTI, G. D. N79-24123
LAMB, M. J. N79-24656
LAMB, W. E., JR. N79-24800
LAMBECK, P. N79-24416
LAMBERT, S. N79-24573
LAMBETH, B. W. N79-24598

LANDAHL, M. T. N79-24303
LANDGREBE, D. A. N79-24410
N79-24415
LANGFELDER, H. N79-23904
LANGHAM, R. W., II N79-24813
LANGHUS, D. L. N79-24082
LANIER, R., JR. N79-24441
LANSING, F. L. N79-24466
LAPSHINSKIY, V. A. N79-24943
LARRABEE, E. E. N79-23903
LASKER, L. N79-24721
LATHAM, E. A. N79-23971
LAUB, A. J. N79-24695
LAWLER, W. H. N79-24823
LAWRENCE, G. W. N79-24164
LAWRENCE, R. N79-24193
LAWTON, R. A. N79-24253
LAYMAN, G. E. N79-24219
LAZZARINO, L. N79-24202
LEADON, R. N79-24044
LEAVENS, W. M. N79-24029
LEBECK, A. O. N79-24357
LEDERER, P. S. N79-24284
LEE, G. K. F. N79-24670
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LEFLER, R. M. N79-24892
LEGGE, R. N79-24473
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LENAHAN, D. T. N79-23974
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LEONARD, C. D. N79-24324
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LEUNG, W. N79-24570
LEVINE, M. W. N79-24740
LEVINE, R. D. N79-24794
LEVY, L. N79-24043
LEWIN, L. N79-24762
LEWIS, H. E. N79-24181
LEWIS, J. L., JR. N79-24653
LEY, K., MARCOS N79-24884
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LIEBERMEISTER, C. N79-24632
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LIEMOHN, H. B. N79-24029
LIGHT, E. S. N79-24631
LILLEVIK, S. L. N79-24664
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LIU, F. C. S. N79-24255
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LIVINGSTON, R. C. N79-24224
LOBEL, R. N79-24313
LOGAN, K. E. N79-24329
LONG, J. A. N79-23952
LONGLEY, J. W. N79-24678
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LORDI, N. J. N79-24546
LORMAN, W. R. N79-24475
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LOUBET, G. N79-24778
LOWRY, L. M. N79-24142
LUBBERS, D. H. N79-24690
LUCAS, J. N79-24464
LUSKUS, L. J. N79-24102
LUSTY, A. H., JR. N79-23947
LUTZ, S. J. N79-24534
LYNCH, D. N79-24756
LYNCH, J. F. N79-24810
LYON, R. J. N79-24530

M

MACAL, K. S. N79-24579
MACDONALD, D. D. N79-24130
MACIOLEK, J. A. N79-24425
MACK, E. J. N79-24533
MACKENZIE, E. N79-24577
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MAIERO, D. J. N79-24522
MAJOROS, S. J. N79-24859
MALBERG, H. N79-24604
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MALILA, W. N79-24415
MALLALEY, G. L. N79-23904
MANDELL, M. J. N79-24813
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MANSFELD, F. N79-24466
MANSOORIAN, H. N79-24943
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MARA, M. J. N79-24721
MARCHAND, M. N79-23971
MARESCA, P. A. N79-24695
MARGRAVE, J. L. N79-24823
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MARINE, I. W. N79-24219
MARKSON, R. N79-24202
MARKWORTH, A. J. N79-24044
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MASSARO, M. J. N79-23951
MASSATT, P. N79-24283
MATHENY, N. W. N79-24892
MATHUR, B. S. N79-24473
MATSUOKA, K. N79-24932
MATTHEWS, F. L. N79-24509
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MAYERSOHN, J. N79-23974
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MAYNE, A. W., JR. N79-24705
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MCLEAN, J. C., JR. N79-24376
MCLEOD, K. W. N79-23894
MCMAHON, J. H. N79-24632
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MCMASTERS, O. D. N79-24029
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MEHTA, N. C. N79-24454
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MELDGIN, M. J. N79-24848
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MENARD, T. A. N79-24224
MENDELL, R. B. N79-24313
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MERGERIAN, D. N79-24678
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METCALF, J. T. N79-24546
MEYER, F. O., III N79-24475
MEYER, H. N79-23936
MICHON, G. J. N79-24778
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MIDDLETON, O. N79-24690
MIDGLEY, D. C. N79-24464
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MILLER, J. B.
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MITSUHASHI, T. N79-24579
MITTRA, N. N79-24130
MITTRA, R. N79-24425
MIYAMOTO, K. N79-24533
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MORIYAMA, J. N79-24087
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MOTYKA, T. N79-24906
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MULINAZZI, T. E. N79-24816
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MUSSARED, M. R. N79-24382
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N

NADEL, L. D. N79-24628
NAGANO, S. N79-24254
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NAGARAJ, H. S. N79-24354
NAGY, D. A. N79-24391
NAKASATO, F. N79-24129
NANEVICZ, J. E. N79-24009
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NARAYANAN, R. N79-24293
NASONI, R. L. N79-24767
NATAN, M. N79-24117
NEAL, W. R. N79-24054
NEER, M. E. N79-24585
NEFF, N. D. N79-24714
NELL, J. H. N79-24468
NELSON, D. A., JR. N79-24118
NEMETHY, E. K. N79-24507
NEUMANN, R. W. N79-23953
NEWTON, D. W. N79-23918
NEYSHTADT, A. I. N79-23995
NGUYEN, D. T. N79-23950
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NICHOLS, K. H. N79-24824
NICKS, O. W. N79-23900
NIESX, D. E. N79-24351
NIKOLAUS, H. N79-24348
NISHIKAWA, K. N79-24844
NISHINOMIYA, G. N79-24888
NIXDORF, J. N79-24065
NORTON, J. M. N79-23947
NOWLAN, M. J. N79-24054
NUYAN, S. N79-24722
NYGAARD, K. J. N79-24059

O

OAKS, J. N79-24756
N79-24757
OBAL, M., W. N79-23956
OBRIEN, T. K. N79-24063
OCH, G. N79-23943
ODONNELL, E. E. N79-24051
OGURA, K. N79-24440
OGUSHWITZ, P. R. N79-24559
OISHI, T. N79-24440
OKAMOTO, Y. N79-24103
OLAH, S. N79-24454
OLER, J. N79-24715
OLIVER, J. E. N79-24589
OLSEN, L. C. N79-24516
OLSEN, R. C. N79-24007
ONDREJKA, A. R. N79-24253
ONiSHCHENKO, Y. M. N79-24943
ONO, K. N79-24125
ORAN, W. A. N79-24026
OSSAKOW, S. L. N79-24233
OSTGAARD, M. A. N79-23957
OTSUKA, M. N79-24835
OTTO, D. C. N79-24830
OTVOS, J. W. N79-24507
OUNBY, P. D. N79-24470
OVERTURF, B. W. N79-24187
OWNBY, J. D. N79-24542
OZKAN, I. N79-24790
OZKAPLAN, H. N79-24860
OZOMARO, C. O. N79-24095

P

PABST, R. L. N79-24099
PAESLEME, P. J. N79-24795
PAGLIETTI, A. N79-24887

PALUCH, E. J. N79-24671
PANDALAI, R. P. N79-24101
PANDL, R. A. N79-24843
PAPWORTH, D. N79-24361
PARK, J. H. N79-24568
PARKER, L. W. N79-24024
N79-24026
PARKS, D. E. N79-24012
PARKS, D. M. N79-24383
PARKS, H. G. N79-24667
PARPIA, J. M. N79-24861
PARVIN, K. N79-24862
PASION, A. J. N79-23940
N79-24172
PASKOWSKY, R. N79-24268
PATHAK, P. H. N79-24211
N79-24229
PAVLISKO, J. A., III N79-24147
PECK, L. B. N79-24149
PEDERSEN, A. N79-24020
PEERCY, P. S. N79-24878
PELTON, E. L. N79-24215
N79-24217
PENCE, W. D. N79-24923
PERAN, F. D. N79-24225
PEREGO, A. N79-24492
PERRAUT, S. N79-24240
PERRIN, J. S. N79-24142
PERRY, D. L. N79-24111
PERRY, P. L. N79-24099
PERSIN, S. M. N79-24601
PERSON, J. K. N79-24431
PESTER, R. F. N79-24673
PETERS, E. G. N79-24222
PETERS, H. G. N79-23993
PETERSON, B. N79-24847
PIAN, C. C. P. N79-24446
PIEPENBURG, D. D. N79-24381
PIERCE, L. S. N79-24863
PIERCE, R. E. N79-24357
PILIE, R. J. N79-24533
PINE, V. W. N79-24018
PINSON, L. J. N79-24222
PIVOVAROV, M. L. N79-23994
N79-23995
PLOTZKER, I. G. N79-24079
POCHKAI, V. P. N79-24064
POCHOLLE, J. P. N79-24822
POEHLMANN, H. C. N79-24071
POLLARD, D. N79-24926
POLOMSKI, R. E. N79-24086
POND, D. O. N79-24274
POPELAR, C. N79-24382
POSSIN, G. E. N79-24667
POTTER, G. L. N79-24617
POTTER, H. R. N79-24538
POURING, A. A. N79-24101
POWELL, R. C. N79-24334
POZZI, M. A. N79-24569
PRAGER, W. N79-24388
PRIEST, J. H. N79-24823
PRILL, J. C. N79-24411
PRINCE, T. C. N79-23974
PROKOPENKO, S. M. L. N79-24015
N79-24016
PRUDHOMME, R. N79-24309
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PSARRAS, T. N79-24153
PUHALA, M. J. N79-24793
PULFORD, C. T. N79-24151
PURVIS, C. K. N79-24006
N79-24013
N79-24030
N79-24033
PUTNAM, T. W. N79-24654

Q

QUINLAN, J. F., JR. N79-24556
QUON, B. H. N79-24843

R

RABINOVICH, M. S. N79-24832
RABINOW, J. N79-24282
RAGHAVAN, S. N79-24187
RAGSDELL, K. M. N79-24508
RAI-CHOUDHURY, P. N79-24472
RAMAIAH, G. K. N79-24375
RAMAKRISHNAN, R. N79-24171
RANGANATH, S. N79-24236
RAO, A. K. N79-24716
RASKA, E., JR. N79-24231
RASMUSSEN, C. N79-24323
RATAJCZAK, A. F. N79-24443
RAUCHWARGER, K. A. N79-24864
RAUH, R. D. N79-24518
RAYMOND, R. C. N79-24667
RAYNOR, G. S. N79-24616
RAZUMOV, L. N. N79-24322
REA, S. N. N79-24451
REAGAN, D. E. N79-24188
RECHESTER, A. B. N79-24765
REDD, J. S. N79-24719
REDDY, J. N79-24036
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REDWINE, W. J. N79-24136
REED, T. N79-24137
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REICHERT, B. N79-24245
REIFF, P. N79-24680
REIFSNIDER, K. L. N79-24383
REILINGER, R. E. N79-24473
REINHARDT, B. A. N79-24412
REINHARDT, V. S. N79-24191
REISE, T. F. N79-24416
REITER, E. R. N79-24252
REKLAITIS, G. V. N79-24525
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RICH, E. I. N79-24270
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RICHER, I. N79-24592
RICHTER, A. N79-24157
RICHTER, T. N79-24207
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RICKMAN, J. D., JR. N79-24565
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N79-24327
N79-23978
ROBERTSON, S. J. N79-23994
ROBINS, K. E. N79-23995
ROBINSON, J. W. N79-24079
N79-24064
ROBINSON, R. L., JR. N79-24822
ROCHE, J. C. N79-24071
N79-24926
N79-24086
N79-24274
ROCHEFORT, J. S. N79-24382
RODRIGUESDEMIRANDA, W. R. N79-24667
RODRIGUEZ, R. N79-24617
ROEDER, W. N79-24538
ROESER, H. A. N79-24101
ROGERS, L. N79-24334
ROGERS, R. B. N79-24569
ROHATGI, A. N79-24388
ROMANOVSKIY, Y. A. N79-24823
ROMANSKY, M. L. N79-24411
ROMPE, K. N79-23974
ROODE, J. D. N79-24015
ROQUES, R. A. N79-24016
ROSENBLATT, M. N79-24309
ROSENBLUTH, M. N. N79-24310
ROSENFIELD, A. R. N79-24153
N79-24793
ROSENTHAL, A. S. N79-24151
ROSS, I. N79-24006
ROSS, M. C. N79-24013
ROSSER, R. W. N79-24030
ROTH, M. N79-24033
ROTTMAN, J. W. N79-24654
ROY, S. M.
ROZVANY, G. I. N.
RUBENSTEIN, A. S.
RUBIN, A. G.
RUSHMORE, W. L.
RUSIN, J. M.
RUSSELL, J. M.
RUSSELL, J. M., III
RUSSELL, P. A.
RUSSELL, W.
RUSSELL, W. A.
RYAN, D. P.
RYNASKI, E. G.

S

SABATIER, P. C.
SAH, C. T.
SAINATI, R. A.
SAKAI, K.
SAMPSON, W. B.
SAMPSON, W. J.
SAN, K. Y.
SANDERS, N. L.
SANDIE, W. S.
SANDIFER, R. H.
SANE, A. Y.
SARRAILHE, S. R.
SASIELA, R. J.
SATO, K. H.
SATURDAY, K. A.
SAVAGE, H. T.
SAWYER, P. L.
SCALA, C. M.
SCHARF, W.
SCHARPF, D. W.
SCHEARER, L. D.
SCHEIBNER, B. A.
SCHELKE, E.
SCHIESSER, W. E.
SCHILLER, J.
SCHILLING, B. E. R.
SCHILLING, J. H.
SCHIMKE, J. T.
SCHLUPE, J. M.
SCHMIDT, R. E.
SCHMUGGE, T. J.
SCHNAUSS, E. R.
SCHNELLE, F.
SCHNUELLE, G. W.
SCHOOL, J. E.
SCHORR, J. R.
SCHUBERT, J. F.
SCHULDT, S. B.
SCHULTZ, W. L.
SCHULZ, M.
SCHUSTER, G. B.
SCHUTZLER, J. C.
SCHWEISS, J. W.
SCOTT, C. D.
SCOTT, I. G.
SCOTT, R. C.
SEAGRAVES, M. A.
SEIDLER, W. A.
SEIKEL, G. R.
SELKOWITZ, S.
SELLEN, J. M., JR.
SERAFINI, T. T.
SERENE, B. E. H.
SESKIN, E. P.
SETHURAMAN, S.
SEVICK, P.
SHAFRANOV, V. D.
SHAGURIN, I. I.
SHAMTSYAN, V. P.
SHAPIRO, I. I.
SHAPIRO, J. H.
SHARMA, A.
SHARP, R. D.
SHAUKATULLAH, H.
SHAW, R. J.
SHEARIN, R. L.
SHELTON, E. M.
SHELTON, J. D.
SHELUS, P. J.
SHEPHARD, M. S.
SHER, L. D.
SHERIDAN, P. F.
SHERIF, A. S.
SHERMAN, C.
SHEU, M. G.
SHEYNDLIN, A.
SHIBATA, M.
SHIH, T. C.
SHIPP, R. F.
SHIRKEY, R. C.
SHIVAMOGGI, B. K.
SHOCKEY, D. A.
SHOJA, M.
SHORSHOROV, M. K.
SHOUPP, W. J.
SHUFORD, R. J.
SHULER, M. P., JR.
SHUMAN, C. A.
SIEGMANN, W. L.
SIENKO, M. J.
SIERRA, R. A.
SIEVERS, M. W.
SILEVITCH, M. B.
SIMONSEN, T.
SIMPSON, W. B.
SINGH, L.
SINGH, M. K.
SINGH, V.
SINK, D. S.
SINK, L. W.
SIOLI, G. C.
SIPPEL, K. O.
SISK, T. R.
SKAGGS, S. R.
SKOKAN, M. R.

SLANKAS, J. T. N79-24787
SLUDER, R. B. N79-24009
SMAILES, J. A. N79-24909
N79-24910
SMALLEY, A. J. N79-24373
SMEDA, M. S. N79-24619
SMITH, A. L. N79-24609
N79-24610
SMITH, D. H. N79-23930
N79-24058
SMITH, E. R. N79-24580
SMITH, J. M. N79-24446
SMITH, L. G. N79-24569
N79-24570
N79-24571
SMITH, M. N79-24062
SMITH, M. A. H. N79-24568
SMITH, W. B. N79-24540
SMITH, W. R. N79-24774
SNIDER, E. H. N79-24085
SNOW, W. R. N79-24059
SNYDER, D. G. N79-24584
SOEDER, R. H. N79-23963
N79-23969
SOMAYAJULU, Y. V. N79-24758
SOMBERG, H. N79-24455
SOMERS, D. M. N79-23891
N79-23902
SONI, Y. N79-24187
SOOD, M. K. N79-24187
SOOD, P. C. N79-24758
SOPORI, B. N79-24473
SORENSEN, E. P. N79-24383
SORENSEN, N. E. N79-23971
SOROKIN, I. P. N79-24112
SOVA, M. N79-24341
SOVEY, J. S. N79-24154
SPAZIANTE, P. M. N79-24492
SPECKHARDT, H. N79-24113
SREENIVASIAH, I. N79-24762
SRIVASTAVA, R. N79-24448
STABRYLLA, R. G. N79-23970
STACH, J. N79-24199
STAEHLE, R. W. N79-24132
STAIC, S. N79-23929
STAPLETON, R. E. N79-24472
STASKUS, J. V. N79-24031
N79-24032
N79-24033
STAUBER, M. C. N79-24027
N79-24045
STEELE, J. L. N79-24561
STEELE, R. K. N79-24119
STEEN, P. G. N79-24011
N79-24012
STEIN, F. P. N79-24176
STEIN, S. R. N79-24733
N79-24734
STEINBERG, M. N79-24491
STEINER, M. N79-24252
STEPHENS, J. B. N79-24432
N79-24433
STEPHENSON, M. J. N79-24084
STETTNER, R. N79-24037
STEVANS, W. N79-23967
STEVENS, D. A. N79-24329
STEVENS, J. R. N79-24002
STEVENS, N. J. N79-24000
N79-24021
STEWART, H. S. N79-24022
STEWART, W. S. N79-24576
STINCHCOMB, W. W. N79-24908
STIRN, R. J. N79-24067
STONE, J. R. N79-24463
STONEHOCKER, G. H. N79-24770
STORER, J. A. N79-24247
STOVER, H. A. N79-24662
STRAIGHT, D. M. N79-24746
STREMILOVA, N. N. N79-23966
STREUBEL, S. N79-24112
STRIDA, M. N79-24901
STRITTMATER, R. C. N79-24939
STROUB, R. H. N79-24175
STUART, J. D. N79-23922
SU, S. Y. N79-24598
SUBRAMANIAN, T. L. N79-24004
SUGGS, H. J. N79-24123
SUH, P. K. N79-24102
N79-24027
N79-24045
SUKHANOV, A. A. N79-24694
SUKYS, R. N79-24587
SUMMERFIELD, M. N79-24173
SUN, M. J. N79-24824
SUNYAYEV, R. A. N79-24934
SUPARINAYOK, B. N79-24196
SWEENKEY, P. B. N79-23917
SYED, V. H. N79-24700
SYRETT, B. C. N79-24130
SZIMMAT, J. N79-24387

T

TALON, M. N79-24803
TANGE, T.
TANTHAPANI CHAKOON, W.
TAPPER, G. O.
TAUCHERT, T. R.
TAUSWORTHE, R. C.
TAYLOR, A. K.
TAYLOR, H. S.
TEALE, J. L.
TECZA, J. A.
TEE, R. G.
TEICH, M.
TETU, M.
THALLER, L. H.
THEETEN, J. B.
THOMAS, G. W.
THOMEE, V.
THOMPSON, E.
THOMPSON, J. R.
THOMS, R. L.
THOMSON, T. A.
THON, L.
THORSNESS, C. B.
TIBOR, N.
TIKHONOV, A. S.
TILLERY, D. G.
TIMBOL, A. S.
TISCHLER, V. A.
TOBIN, R. G.
TODD, R. A., II
TOKUDA, S.
TOMLINSON, H. W.
TOMLINSON, L. A.
TORBERT, R. B.
TORNO, H. C.
TOUZEAU, M.
TRESSLER, R. E.
TRIVEDI, M. C.
TRIVICH, D.
TROLLINGER, J. D.
TROTTA, R.
TRUSCELLO, V. C.
TSENG, W. T. T.
TSOU, K. C.
TUCKER, C.
TULINOV, A. F.
TUNGATE, F. L.
TUPPER, B. C.
TURNER, J. R.

U

UCKAN, N. A. N79-24842
UENSAL, E. N79-24408
UNDERWOOD, R. E. N79-23989
UNGER, D. R. N79-24890
URASEK, D. C. N79-23967
USNICK, G. B. N79-24181

V

VAKILI-DASTJERD, A. N79-23907
VALENCA, J. M. E. N79-24724
VALENT, P. J. N79-24198
VALLES, J. R. N79-24042
VALLEY, M. N79-24332
VALOVCIN, F. R. N79-24582
VANALSTYNE, D. N79-24268
VANDENBROEK, C. N79-24361
VANDEVENTER, E. N. N79-24665
VANDONGEN, B. N79-24910
VANDRE, R. N79-24010
VANIER, J. N79-24741
VANLINT, V. A. J. N79-24037
VANNORDSTRAND, P. N79-24642
VARGO, R. D. N79-24893
VARY, A. N79-24359
VAZ, L. E. N79-24308
VENKAYYA, V. B. N79-24379
VERRET, D. P. N79-24866
VERSCHELL, H. J. N79-24631
VESPRINI, R. L. N79-24668
VEZZETTI, C. F. N79-24284
VISSER, C. J. N79-23983
VITTORIA, C. N79-24235
VOGELSONG, T. L. N79-24919
VOGT, S. S. N79-24918
VONRAD, U. N79-24592
VOSBURGH, K. G. N79-24667
VOSS, H. D. N79-24569
N79-24570
N79-24571
VYKUKAL, H. C. N79-24651

W

WAAG, W. L. N79-23985
WAKEFIELD, G. F. N79-24449
WALKER, T. O. N79-24867
WALKER, W. N79-23997
WALLACHY, B. E. N79-24889
WALLS, F. L. N79-24733
N79-24734
WALOWIT, J. A. N79-24354
WALZ, A. N79-23910
WANG, E. Y. N79-24514
WANG, H. E. F. N79-23989
WANG, J. N79-24333
WANG, N. N. N79-24211
WANG, T. G. N79-24197
WARD, J. R. N79-24175
WARDRIP, S. C. N79-24756
N79-24729 N79-24757
WARNER, J. S. N79-24111
WARREN, H. N79-24757
WASILKOWSKI, G. W. N79-24674
WATTS, C. N79-24332
WATTS, J. R. N79-24524
WAUGH, R. C. N79-24174
WAYLAND, P. K. N79-24691
WEBER, J. N79-24074
WEBER, W. H. N79-24181
WEBSTER, R. T. N79-24876
WEDEVEN, L. D. N79-24350
WEEKS, L. H. N79-23989
WEGMAN, R. F. N79-24161
WEHRBEIN, W. N79-24567
WEI, B. S. N79-24868
WEICHERT, C. F. N79-24910
WEIDE, W., JR. N79-24187
WEIGEL, W. N79-24592
WEILUND, J. N79-24845
WEINGARTEN, N. N79-23978
WEISGERBER, D. N79-24395
WELLS, W. C. N79-24916
WENHAM, R. J. N79-23947
WENOCUR, R. D. S. N79-24708
WENTWORTH, S. E. N79-24070
WESTENBERG, H. N79-24390
WHELAN, D. J. N79-24160
WHIPPLE, E. C. N79-24007
N79-24008
WHIPPLE, W., JR. N79-24428
WHISMAN, M. L. N79-24178
WHISTLING, K. N79-24901
WHITE, R. B. N79-24765
WHITE, R. J. N79-24636
N79-24640
WHITMAN, P. G. N79-24886
WHITMORE, D. H. N79-24506
WHITTEN, G. Z. N79-24531
N79-24532
WHITWORTH, G. N79-24756
N79-24757
WICHMANN, H. N79-24352
WIDNALL, S. E. N79-24303
WIKER, G. A. N79-24652
WILHELMSSON, H. N79-24340
N79-24844
N79-24845
N79-24847
N79-24849
WILKENFELD, J. N79-24044
WILKINS, J. R. N79-24073
WILKINSON, C. R. N79-24187
WILLAM, K. J. N79-24308
WILLIAM, K. J. N79-24387
WILLIAMS, R. E. N79-24543
WILLIAMS, R. H. N79-24329
WILLIAMS, S. G. N79-24209
WILLIAMSON, H. J. N79-24598
WILLIARD, M. W. N79-24748
WILLS, R. R. N79-24351
WILMOT, W. N79-24619
WILSON, C. B. N79-24528
N79-24529
WILSON, L. N79-24122
WILSON, R. N79-24919
WILSON, R. B. N79-24933
WILSON, R. P. N79-24104
WILSON, R. R., JR. N79-24540
WILSON, T. N79-24829
WILSON, W. N79-24449
WING, S. S. N79-24130
WINGFIELD, M. A. N79-24252
WINKLER, G. M. R. N79-24732
WINTER, W. R. N79-24654
WINZER, S. R. N79-24929
WIPF, S. L. N79-24879
WISSMAN, G. N79-24592
WITTE, D. R. N79-24615
WITTENBERG, L. J. N79-24505
WOHLGEMUTH, J. H. N79-24456
WOLF, S. A. N79-24277
N79-24738
WOLFE, C. M. N79-24265
N79-24824
WOLFENSON, M. N79-24717
WOLKOVITCH, J. N79-23954
N79-23955
WONG, H. V. N79-24814
WOOLAVER, L. B. N79-24576
WOOTTEN, H. A. N79-24924

WORKHOVEN, R. M. N79-24512
WOZNIAKOWSKI, H. N79-24674
WRIGHT, J. G. N79-24537
WYCOFF, R. L. N79-24906
WYKES, M. E. P. N79-24312
N79-24314
WYSONG, R. R. N79-23974

Y

YADLOWSKY, E. J. N79-24040
YAKIMENKO, I. P. N79-24849
YAMADA, T. N79-24523
YANG, J. N. N79-24069
YARMCHUK, E. J. N79-24869
YASUI, R. K. N79-24431
YAVIN, Y. N79-24698
YEATES, R. E. N79-24272
YEE, J. H. N79-24877
YEGUNOVA, M. N79-24630
YERUSHALMI, J. N79-24186
YEUNG, P. N79-24067
YIM, S. J. N79-24366
YINNON, H. N79-24152
YOKSAN, S. N79-24114
YORK, J. E. N79-24589
YOUNG, R. N. N79-24073
YOUNG, R. W. N79-24256
YOUNG, S. J. N79-24826
YOUNGER, P. R. N79-24452
YU, B. B. N79-24470
YUNG, E. N79-24234

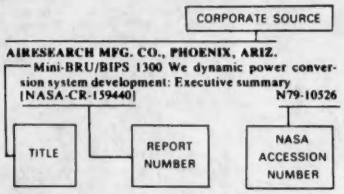
Z

ZABLOTSKIY, I. Y. N79-23976
ZAKHAROV, L. E. N79-24831
ZANETTI, L. J., JR. N79-24552
ZANG, T. A. N79-24921
ZASCHEL, J. M. N79-24402
ZATYKA, H. N79-24940
ZECK, H. N79-23997
ZHEZHKO, I. N79-24948
ZINGMARK, R. G. N79-24418
ZOOK, J. D. N79-24453
ZUCKERWAR, A. J. N79-24203

CORPORATE SOURCE INDEX

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS VOLUME 17 NUMBER 15

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS [FRANCE].

Technical evaluation report on the 27th Guidance and Control Panel Symposium on the V/STOL Aircraft at Night and in Poor Visibility
[AGARD-AR-142] N79-23946

Technical evaluation report on the 26th guidance and control panel symposium on the impact of integrated guidance and control technology on weapons systems design
[AGARD-AR-140] N79-23957

Technical evaluation report on the Fluid Dynamics Panel Symposium on Dynamic Stability parameters
[AGARD-AR-137] N79-23981

Research and development activities in Italy in the field of aerospace structures and materials
[AGARD-R-675] N79-24202

AEROCHEM RESEARCH LABS., INC., PRINCETON, N. J.

Development of a model and computer code to describe solar grade silicon production processes
[NASA-CR-158679] N79-24448

AERODYNE RESEARCH, INC., BEDFORD, MASS.

Initiation phenomena in pulsed chemical lasers
[AD-A065885] N79-24330

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.

Seasonal variations in ultraviolet single scattering phase functions
[AD-A066160] N79-24585

AERONAUTICAL RESEARCH LABS., MELBOURNE [AUSTRALIA].

An introduction to dynamic derivatives. 2: The equations of motion for wind tunnel pitch-yaw oscillation rigs
[ARL-AERO-NOTE-377] N79-23982

Simple acoustic emission tests for the detection of corrosion
[AD-A065965] N79-24122

Reliability and structural fatigue in one-crack models
[ARL-STRUC-REPT-369] N79-24371

Simple formulae for calculating the vibrational frequencies of plates, shells and membranes
[ARL-STRUC-REPT-371] N79-24374

Impact tests on crash helmets for motor cyclists
[AD-A065966] N79-24655

Acoustic emission spectral calibration and analysis
[ARL-MAT-NOTE-125] N79-24772

AEROSPACE CORP., EL SEGUNDO, CALIF.

Five year plan for space test program
[AD-A065866] N79-23989

Description of the Space Test Program P78-2 spacecraft and payloads
N79-24002

Description and charging results from the RSPM
N79-24010

Auroral magnetosphere-ionosphere coupling: A brief topical review
[NASA-CR-158662] N79-24572

Scattering of solar radiation by clouds
[AD-A062828] N79-24826

AGNEW TECH-TRAN, INC., WOODLAND HILLS, CALIF.

Elastic-plastic torsion of prismatic bars with polygonal cross section
[ETEC-TRANS-1] N79-24384

AIR FORCE ACADEMY, COLO.

Aircraft engine oil analysis by neutron activation techniques
[AD-A066202] N79-24169

Test and evaluation of split ring shear connectors in laminated wood and laminated wood bolts
[AD-A066323] N79-24381

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.

Prediction of the angular response power spectral density of aircraft structures
[AD-A066141] N79-23956

Conference on Aerospace Polymeric Viscoelastic Damping Technology for 1980's
[AD-A065518] N79-24157

ANALYZE: Analysis of aerospace structures with membrane elements
[AD-A065633] N79-24379

Collision induced dissociation of diatomic molecules
[AD-A066191] N79-24798

Discharge processes in the oxygen plasma
[AD-A066196] N79-24841

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.

Icing of aircraft Some remarks with an historical slant from a cloud physicist
N79-23915

Modeling of the geosynchronous plasma environment
N79-24003

ATS-5 and ATS-6 potentials during eclipse
N79-24005

Design, development, and flight of a spacecraft charging sounding rocket payload
N79-24009

The calculation of spacecraft potential: Comparison between theory and observation
N79-24019

A comparison of theoretical and experimental results in supercooled stratus dispersal
[AD-A063013] N79-24581

Spectral radiance of snow and clouds in the near infrared spectral region
[AD-A063761] N79-24582

A feasibility study of the use of radiant energy for fog dispersal
[AD-A063143] N79-24613

AIR FORCE HUMAN RESOURCES LAB., BROOKS AFB, TEX.

Contributions of platform motion to simulator training effectiveness. Study 2: Aerobatics
[AD-A064305] N79-23985

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.

The production function and airframe cost estimation
[AD-A065570] N79-23952

A methodology for an effectiveness analysis of RPV's in a chaff dispensing role
[AD-A065557] N79-23953

Effects of antenna arrays on broadband signals
[AD-A064679] N79-24231

Estimation of aircraft target motion using pattern recognition orientation measurements
[AD-A066195] N79-24682

New techniques for tracking sequences of digitized images
[AD-A066194] N79-24828

An exploratory study for design of a propulsion deputate management information system
[AD-A065883] N79-24889

An investigation of a human information processing model for decision making
[AD-A065912] N79-24890

Evaluation of computer aided indexing of information for support of contract appeals
[AD-A065835] N79-24893

AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.

Effects of isothermal forging conditions on the properties and microstructures of Ti-10V-2Fe-3Al
[AD-A066062] N79-24124

Synthesis and properties of benzil end-capped acetylene terminated phenylquinoxalines [batqs]
[AD-A066335] N79-24167

Polymeric materials containing aromatic enyne linkages
[AD-A066334] N79-24168

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.

Theory of thin wing in a supersonic flow with consideration of the non-equilibrium state of excitation of oscillating degrees of freedom
[AD-A065992] N79-23928

Supersonic flow in the area of antisymmetric thin cruciform wings with supersonic leading edges in a horizontal plane, with consideration of flow separation on the edges
[AD-A065993] N79-23929

Measurement of resonance vibrations of turbine blades with the Elura device
[AD-A066122] N79-23976

AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.

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[NASA-CR-161204] N79-24437

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N79-24146

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N79-24151

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N79-24659

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N79-24863

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N79-24082

Finite element analysis of arbitrary shells
N79-24368
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N79-24767
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[COO-4294-2] N79-24800
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N79-24818

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[AD-A065512] N79-24269
Documentation of software in the OL-192 meteorological data reduction program
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[AD-A065915] N79-24158

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N79-23919
Interactional aerodynamics of the single rotor helicopter configuration. Volume 6B: One-third octave band spectrograms of wake single film data, basic configuration wake explorations
[AD-A061861] N79-23931
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3A: Flow angle and velocity wake profiles in low frequency band, basic investigations and hub variations
[AD-A061766] N79-23932
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3B: Flow angle and velocity wake profiles in low frequency band, air ejector systems and other devices
[AD-A061767] N79-23933
Interactional aerodynamics of the single rotor helicopter configuration. Volume 2B: Harmonic analyses of airframe surface pressure data, runs 7 - 14, midsection
[AD-A061860] N79-23934

ARO, INC., ARNOLD AIR FORCE STATION, TENN.
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[AD-A065594] N79-23927
Model diffuser investigation for propulsion wind tunnel 16T
[AD-A065822] N79-23984

AUBURN UNIV., ALA.
Automatic target hand-off for non-compatible imaging systems
[AD-A065525] N79-24222

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[PB-290558/6] N79-24535

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[AD-A065645] N79-23926

B

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Outgassing tests of fiber-epoxy composite materials
[SAND-78-7075] N79-24071

BATTELLE COLUMBUS LABS., OHIO.
Identification of organic compounds in industrial effluent discharges
[PB-291900/9] N79-24111
Effects of hot forging variables upon microstructure and properties of metals and alloys
[AD-A065674] N79-24123
Evaluating strength and ductility of irradiated zircaloy, task 5
[PB-291511/4] N79-24142
Heliostat glass survey and analysis
[PNL-2868] N79-24170
Study of heat transfer through refractory lined gasifier vessel walls
[FE-2210-29] N79-24306
Development and evaluation of die and container materials. Low cost silicon solar array project
[NASA-CR-158670] N79-24351
Critical experiments, measurements, and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[NUREG-CR-0583] N79-24382
Critical experiments, measurements and analyses to establish a crack arrest methodology for nuclear pressure vessel steels
[PB-291190/7] N79-24405
Heat source component development program
[BMI-X-699] N79-24799

BECHTEL CORP., SAN FRANCISCO, CALIF.
Analysis of coal hydrogasification processes
[FE-2565-13] N79-24183

BELL TELEPHONE LABS., INC., MURRAY HILL, N. J.
Calculation of the Kolmogorov entropy for motion along a stochastic magnetic field
[PPPL-1523] N79-24765

BENDIX CORP., KANSAS CITY, MO.
Predicting stress corrosion cracking in welded steel based on residual stress measurements
[BDX-613-2099-REV] N79-24131
Logic circuit simulation and automatic fabrication
[BDX-613-2070-REV] N79-24278
Contaminant identification for an electromechanical unit
[BDX-613-2116-REV] N79-24279
Microprocessors as a tool in determining correlation between sferics and tornado genesis
[BDX-613-2122] N79-24615

BERTELSEN MFG. CO., INC., NEPONSET, ILL.
Introduction to the arcopter arc wing and the Bertelsen effect for positive pitch stability and control
N79-23895

BOEING AEROSPACE CO., HOUSTON, TEX.
Fluid sample collection and distribution system
[NASA-CASE-MSC-16841-1] N79-24285

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Development of Precision Optical Path Alignment System [POPAS]
[AD-A065673] N79-24823

BOEING AEROSPACE CO., SEATTLE, WASH.
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[NASA-CR-159018] N79-23997
Plasma particle trajectories around spacecraft propelled by ion thrusters
N79-24029
Design fabrication and test of graphite/polyimide composite joints and attachments for advanced aerospace vehicles
[NASA-CR-159080] N79-24066

BOEING COMMERCIAL AIRPLANE CO., SEATTLE, WASH.
Low-speed single-element airfoil synthesis
N79-23890
Inflight fuel tank temperature survey data
[NASA-CR-159569] N79-23940
Design and evaluation of aircraft heat source systems for use with high-freezing point fuels
[NASA-CR-159568] N79-24172

BOEING COMPUTER SERVICE CO., INC., MCLEAN, VA.
LHC-PILOT, user guide
[PB-291985/0] N79-24676
LHC-PILOT, system guide
[PB-291986/8] N79-24677

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[AD-A061861] N79-23931
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3A: Flow angle and velocity wake profiles in low frequency band, basic investigations and hub variations
[AD-A061766] N79-23932
Interactional aerodynamics of the single rotor helicopter configuration. Volume 3B: Flow angle and velocity wake profiles in low frequency band, air ejector systems and other devices
[AD-A061767] N79-23933
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[AD-A061860] N79-23934

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[PB-292697/0] N79-24252
Interlap-11
[AD-A066142] N79-24675

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[AD-A062310] N79-24580

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[BBC-RD-1979/6] N79-24320

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Composite materials with superplastic matrix
[BLL-RTS-11722] N79-24064
Some physical and chemical properties of sodium-aluminate solutions
[BLL-RTS-11347] N79-24074
Automatic numerical correction for technicon autoanalyser output
[BLL-RTS-11785] N79-24096
Conditions of precipitation of aluminum hydroxide and hydrated silica on the surface of titanium dioxide
[BLL-RTS-11737] N79-24112
Nickel coatings achieved without the use of electric current
[BLL-RTS-11605] N79-24113
Rapid method for determining free formaldehyde in phenol-formaldehyde resins
[BLL-RTS-11594] N79-24144
Influence of air characteristics on the calibration of a variable-area flowmeter
[BLL-RTS-11718] N79-24321
The holographic recording of a moving water aerosol
[BLL-TRANS-1370-[9022.549]]
N79-24322
Method for determining the state of a fuel mixture at the inlet manifold of an M 207 motor under non-adiabatic conditions
[BLL-RTS-11509] N79-24341
Two-stage supercharger sets: Efficiency and head distribution under full- and part-load conditions
[RTS-11613] N79-24342
Investigation of air flow processes in the combustion chambers of direct-injection diesel engines
[RTS-11620] N79-24343
Pneumatic Carburation [PC] for internal combustion engines with spark ignition
[BLL-RTS-11758] N79-24345
Investigations into mixture preparation and combustion in the hydrogen engine
[BLL-RTS-11807] N79-24346
The 1.11 new considerations on the development of vortex ports
[BLL-RTS-11759] N79-24347
The acceleration and braking capability of hydrostatic transmissions
[BLL-RTS-11821] N79-24348
Method for determining Polycyclic Aromatic Hydrocarbons [PAH] and phenols in exhaust gas condensates using thin-layer fluorimetry and UV spectroscopy
[BLL-RTS-11654] N79-24521
On the quantum mechanical theory of ball lightning
[BLL-CTO/1560-[9091.9F]] N79-24563
The advection of surface water temperature by wind currents
[BLL-TRANS-1369-[9022.549]]
N79-24600
The distribution of maximum wind speed
[BLL-TRANS-1368-[9022.549]]
N79-24601
Obtaining weather data by radar in Switzerland
[BLL-TRANS-1389-[9022.549]]
N79-24602
Change of the temperature trend over the North Atlantic since 1970
[BLL-TRANS-1392-[9022.549]]
N79-24603

A simple method for an objective, local forecast of gusts
[BLL-TRANS-1393-[9022.549]] N79-24604
A method for forecasting flight visibility in bad weather
[BLL-TRANS-1394-[9022.549]] N79-24605
Probe measurement technique in a Tokamak
[BLL-CTO/1563-[9091.9F]] N79-24831
Eighth European Conference on Controlled Fusion and Plasma Physics: A review
[BLL-CTO/1485-[9091.9F]] N79-24832

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Cost-effective potential of optimumly designed heat pumps for the collection, storage, and distribution of solar energy
[BNL-25195] N79-24307
Thermoelectrochemical cycles for power and hydrogen production
[BNL-24387] N79-24491
Hydrogen halogen energy storage system
[BNL-25212] N79-24492
General-equilibrium approach to energy/environmental economic analysis
[BNL-24781] N79-24504
Method for the comparative economic assessment of energy storage systems
[BNL-25291] N79-24509
Effects of changes in upwind surface characteristics of mean wind speed and turbulence near a coastline
[BNL-25178] N79-24616
Magnetization effects in superconducting accelerator magnets
[BNL-24939] N79-24815

BROWN UNIV., PROVIDENCE, R. I.
Research in gas lasers
[AD-A065743] N79-24331
Recent finite element studies in plasticity and fracture mechanics
[COO-3084-62] N79-24383
Some properties of condensing maps
[AD-A065630] N79-24726

BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE, HANNOVER [WEST GERMANY].
Results of the geoscientific investigations from the VALDIVA cruise VA-10/1975 off Western Africa
[BMFT-FB-M-78-03] N79-24592
Investigations of sediment cores from the central Pacific SE of Hawaii from the VALDIVIA cruise 13/1
[BMFT-FB-M-77-08] N79-24624

BUNDESMINISTERIUM FUER FORSCHUNG UND TECHNOLOGIE, BONN [WEST GERMANY].
High speed TV-towing system for project definition study for conception and design of a deep sea towing system with two instrumented exploration instrumental bodies in a tandem configuration for close to sea floor control
[BMFT-FB-M-77-05] N79-24623

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Linear least squares regression algorithm: NMGS2
[PB-290475/3] N79-24678

BUSINESS AND TECHNOLOGICAL SYSTEMS, INC., SEABROOK, MD.
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[NASA-CR-159926] N79-24892

C

CALIFORNIA ENERGY COMMISSION, SACRAMENTO.
Feasibility and economics of cogeneration in California's thermal enhanced oil recovery operations
[PB-291794/6] N79-24517
Inventory of underground energy storage sites in California
[PB-290835/8] N79-24519

CALIFORNIA INST. OF TECH., PASADENA.
Selective transport of sulfur-dioxide through polymer membranes N79-24089
A chemically reacting, turbulent shear layer N79-24286
Generalized ray models of strong ground motion N79-24557
A method for waveform inversion of body-wave seismograms N79-24558
Some observations on the random response of linear and nonlinear dynamical systems
[PB-290808/5] N79-24596
Interaction potentials of atom-molecule and molecule-molecule systems from crossed beam experiments N79-24787
New optical waveguide devices using periodic and chirped surface corrugations and optical waves in periodic layered structures N79-24820
Ion bombardment effects on material compositions: Preferential sputtering and atomic mixing N79-24858
Barotropic and baroclinic instabilities in jupiter's zonal flow N79-24926
Studies of calcium isotope fractionation found in nature and produced during ion sputtering N79-24927

CALIFORNIA RESEARCH AND TECHNOLOGY, INC., WOODLAND HILLS.
Numerical investigations of fracture and micromechanics in ceramics
[AD-A066252] N79-24166

CALIFORNIA UNIV., BERKELEY.
Spacecraft potential control on ISEE-1 N79-24020
Structural and dynamic considerations in molecular collision theory
[AD-A065531] N79-24794

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Transparent heat mirrors for passive solar heating applications
[LBL-7829] N79-24476
Hydrocarbons and energy from plants
[LBL-8596] N79-24507
Lie transforms and their use in Hamiltonian perturbation theory
[DOE/ET-0074] N79-24727
Cartographic base files at Lawrence Berkeley Labortory: 1978 inventory
[LBL-8707] N79-24894

CALIFORNIA UNIV., DAVIS.
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236

CALIFORNIA UNIV., IRVINE.
The optimal tracking problem for nonstationary stochastic processes
[AD-A062689] N79-24700

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
In situ coal gasification modeling
[UCRL-82269] N79-24479
General-purpose aluminum-air/flywheel electric vehicles
[UCRL-82003] N79-24503
Preliminary zonal model analysis of the climatic change resulting from increased atmospheric carbon dioxide
[UCRL-81575] N79-24617
Systematic computation of the performance of photovoltaic based on first principles
[UCID-1804-PT-1] N79-24877

CALIFORNIA UNIV., LOS ANGELES.
Magnetomechanical acoustic emission of iron and steels
[AD-A066082] N79-24125
Development of preferred orientation in uniaxially deformed olivine aggregates N79-24554

CALIFORNIA UNIV., RIVERSIDE.
Local electronic properties of dilute magnetic alloys N79-24114
Distribution of positive ion species above a diffuse midnight aurora N79-24550
Spatial characteristics of net radiation and its components for Ontario N79-24562
Differential cross section measurements for electron impact on barium in ground and laser excited states N79-24785
Specific heats of single crystal europium sulfide, selenide, and telluride near their magnetic phase transitions N79-24855
Host nuclear spin relaxation in superconducting alloys of 3d transition metals in aluminum N79-24862
Dissipation of temperature perturbations in a planetary atmosphere by radiative transfer N79-24928
Localized sources of gamma rays of 3 to 25 MeV N79-24933

CALIFORNIA UNIV., SAN DIEGO.
Operations of the ATS-6 ion engine N79-24007
Characteristics of differential charging of ATS-6 N79-24008
Numerical calculations of periodic gravity-capillary waves N79-24287
The structure of turbulent velocity fields
[AD-A065666] N79-24304
Ionspheric electrodynamics and its coupling to the magnetosphere N79-24549
Nonlinear optical processing with Fabry-Perot interferometers N79-24817

CALIFORNIA UNIV., SANTA BARBARA.
Neutrinos and long-range weak forces in cosmology N79-24882

CALSPAN CORP., BUFFALO, N. Y.
Active control for the Total-In-Flight simulator [ACTIFS]
[NASA-CR-3118] N79-23978
Laboratory investigation of the photooxidation and catalytic oxidation of SO2
[PB-290859/8] N79-24533

CANADA INST. FOR SCIENTIFIC AND TECHNICAL INFORMATION, OTTAWA [ONTARIO].
Rate of desulfurization from liquid iron and iron alloys with hydrogen
[NRC/CNR-TT-1930] N79-24120
Thermodynamic studies of MnS and FeS by CaF2 solid electrolyte galvanic cell technique
[NRC/CNR-TT-1929] N79-24440

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
Optical pattern recognition for terminal guidance guidance
[AD-A062821] N79-23942
Crystallographic and fractographic studies of hydrogen-induced cracking in purified iron and iron-silicon alloys
[AD-A062423] N79-24129
Optimality of spline algorithms
[AD-A065637] N79-24674
Further theory of stable decisions N79-24710

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Fundamentals of ordinary ion exchange N79-24094
A proton activation study of oxygen diffusion in multicomponent glass-forming systems N79-24152
A discrete parameter model of the head and neck with neuromuscular feedback N79-24627
Characteristics and applications of distributed associative memory algorithms N79-24661
A modified Robbins-Monro procedure and its applications N79-24716

CATALYTIC, INC., WILSONVILLE, ALA.
Solvent Refined Coal [SRC] process: Operation of solvent refined coal pilot plant
[FE-2270-34] N79-24181

CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.
A FORTRAN code for the calculation of sound propagation in a range dependent ocean 2. Range functions and mode coupling
[AD-A062916] N79-24775

CENTRE DE RECHERCHES DE LA COMPAGINE GENERALE D'ELECTRICITE, MARCOUSSIS [FRANCE].
Diversion and modulation of optical energy in graded index multimode fiber optics
[REPT-77-213/R] N79-24822

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MEUDON [FRANCE].
Diffusion and heat transfer in a plane horizontal film
[REPT-77-2] N79-24309
Gravity waves and diffusion in a liquid covered by a superficial film
[REPT-77-3] N79-24310

CESSNA AIRCRAFT CO., WICHITA, KANS.
A review of the icing situation from the standpoint of general aviation N79-23918

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG [SWEDEN].
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339
Catastrophe theory in Hilbert Space
[CTH-MATH-1977-17] N79-24703
L sub p-intensities of random measures
[CTH-MATH-1978-2] N79-24704
Convergence of non-ergodic dynamic systems
[CTH-MATH-1977-18] N79-24720
A refinement of Lebesgue's measure decomposition
[CTH-MATH-1978-1] N79-24728
On rational approximations of semigroups
[CTH-MATH-1978-3] N79-24729
Study of similarity flows of two component laser produced plasmas N79-24844
A perturbation expansion for the nonlinear Schroedinger equation with application to the influence of nonlinear Landrau damping
[CTH-IEFT/PP-1977-12] N79-24845
Resonant modes of a toroidal plasma in the large major radius approximation
[CTH-IEFT/PP-1977-13] N79-24846
Coupled nonlinear Schroedinger equations including growth and damping
[CTH-IEFT/PP-1977-14] N79-24847
Wave interaction in a beam-plasma system in the presence of dispersion and higher order nonlinear effects
[CTH-IEFT/PP-1977-15] N79-24848
Fluctuations in active molecular plasmas
[CTH-IEFT/PP-1978-1] N79-24849

CHEMICAL ENGINEERING RESEARCH GROUP, PRETORIA [SOUTH AFRICA].
High surface area amorphous silica-alumina cracking catalysts with controlled site spacings
[CSIR-CENG-232] N79-24068
CH2M/HILL, INC., GAINESVILLE, FLA.
Report to Congress on control of combined sewer overflow in the United States
[PB-291966/0] N79-24906
CINCINNATI UNIV., OHIO.
Three-dimensional internal flows in turbomachinery. Task 1: Secondary flow in diffusing cascades
[AD-A065696] N79-23972
Automation of an ultraviolet-visible spectrometer
[PB-290831/7] N79-24327
CITY COLL. OF THE CITY UNIV. OF NEW YORK.
Improved techniques for gasifying coal
[FE-2340-7] N79-24186
CITY OF DESERT HOT SPRINGS, CALIF.
Self-starting manual for direct use applications of geothermal resources
[PB-290872/1] N79-24423
CLEMSON UNIV., S.C.
A kinetic study of the reactions of biphenyl and chlorine in water to form chlorobiphenyls N79-24085
The Hankel autocorrelation N79-24690
Low temperature properties of bismuth films in large electric and magnetic fields N79-24867
Cylindrical Josephson tunneling N79-24871
Simulation and control of advanced wastewater treatment systems N79-24895
COLORADO SCHOOL OF MINES, GOLDEN.
Clean solid and liquid fuels from coal
[FE-2047-8] N79-24185
COLORADO STATE UNIV., FORT COLLINS.
Characterization of electrical discharges on Teflon dielectrics used as spacecraft thermal control N79-24040
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. Appendix E: Program listing
[NASA-CR-158632] N79-24296
MANTLE: A finite element program for the thermal-mechanical analysis of mantle convection. A user's manual with examples
[NASA-CR-158631] N79-24297
Conjunctive ground and surface water allocations: The economics of a quasi-market solution
[PB-290992/7] N79-24429
Variation of the ocean-atmosphere system as a consequence of feedback mechanisms
[COO-1340-58] N79-24622
Development of a drainage and flood control management program for urbanizing communities, part 1
[PB-290997/6] N79-24903
Development of a drainage and flood control management program for urbanizing communities, part 2
[PB-290998/4] N79-24904
Research needs for community water management
[PB-291938/9] N79-24905
COLORADO UNIV., BOULDER.
Evaluation and prediction of avalanche hazard, San Juan Mountains, Colorado
[PB-290854/9] N79-24594
Diffraction by a dielectric wedge
[AD-A065699] N79-24762
COLORADO UNIV. AT BOULDER.
Dynamics of a continuous thickener handling a compressible slurry N79-24083
The effects of finite size on the critical behavior of fluid films N79-24288
Rotational flows in electrically conducting and nonconducting fluids N79-24289
Identification and order reduction of dynamical systems N79-24723
Perturbation theory of some nonlinear problems in mechanics of solids, fluids, and plasmas N79-24730
Field theories with multiple Fermionic excitations N79-24806
A configuration space study of low energy pion-nucleus scattering N79-24811
Time delay in quantum scattering N79-24885
COMMITTEE ON BANKING, HOUSING AND URBAN AFFAIRS [U. S. SENATE].
Impact of solar energy on rural housing
[GPO-31-641] N79-24467
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION [U. S. SENATE].
Propelled lighter-than-air vehicles
[GPO-43-457] N79-23925
US civilian space policy
[GPO-42-110] N79-23988
COMPUTER SCIENCES CORP., HAMPTON, VA.
A marching method for calculating line and continuum radiation in high energy flow fields
[NASA-CR-3046] N79-24302
COMPUTER SCIENCES CORP., SILVER SPRING, MD.
Contingency study for the third international Sun-Earth Explorer [ISEE-3] satellite
[NASA-CR-159931] N79-23996
CONNECTICUT UNIV., STORRS.
Photoacoustic spectroscopy: Its application to the study of solid materials N79-24081
The fatigue of Ti6Al4V alloy in coarse and fine structural conditions under fully reverse loading as well as pulsating tension N79-24119
Biodegradable polymer: Synthesis and characterization of methyl- and hydroxyl-containing polyamides, polyfumaramides, and polyenamines N79-24147
Noise performance of broadband amplifiers for use with electrically small antennas N79-24208
Vibration and stability of beam reinforced polar orthotropic annular plates of uniform and variable thickness N79-24363
On the axisymmetric contact of closely conforming elastic bodies N79-24364
Determination of earthquake source characteristics by computer simulation of teleseismic P-wave pulses N79-24559
An interactive classical control design algorithm for multivariable systems in state-space form N79-24670
Bivariate nonparametric tests for the one-sample location problem N79-24711
Optical polarization measurements and excitation mechanisms in low energy ion-atom collisions N79-24782
A nuclear magnetic resonance and bulk magnetic susceptibility study of Ni-Pd-P and Ni-Pt-P metallic glasses N79-24856
Photoemission and optical studies of free base tetraphenylporphyrin and magnesium tetraphenylporphyrin N79-24868
CORNELL UNIV., ITHACA, N. Y.
Numerical calculation of inviscid transonic flow through rotors and fans N79-23906
Molecular orbital studies of bonding and reactivity in organometallic transition metal complexes and cluster compounds N79-24076
A semiempirical approach for resonance Raman intensities N79-24078
The kinetics of the methanation of carbon monoxide on silica-supported nickel catalysts N79-24092
Morphology and mechanism of hydrogen attack in iron-carbon alloys N79-24117
Metallic xenon N79-24118
An experimental investigation of the natural convection boundary layer over a uniform flux inclined surface N79-24294
A systems procedure for land use and water quality planning in a rural watershed N79-24406
Recent vertical crustal movements from leveling observations in the Rio Grande rift: A review
[LA-UR-78-3195] N79-24589
Finite element grid optimization with interactive computer graphics N79-24692
Inference and decision making based on interval-valued probability N79-24717
Superconductivity in nonstoichiometric compounds, layers, and chalcogen ternaries
[AD-A065668] N79-24761
Acoustic emission and propagation of elastic pulses in a plate N79-24768
Theory of foil-less diodes N79-24808
A study of grating filters in thin-film optical waveguides N79-24819
Carbon segregation on platinum, palladium and cobalt single crystal surfaces N79-24853
The viscosity of normal and superfluid helium three N79-24861
Superfluid 3He in narrow cylinders N79-24873
Pulsar timing results from Arecibo Observatory N79-24917
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA [SOUTH AFRICA].
Modelling the wind-field in the Pretoria region: Model description and validation
[CSIR-APRG/78/1] N79-24609
Modelling the wind-field in the Pretoria region. Appendix: Model program description and operation
[CSIR-APRG/78/2] N79-24610

D

DANISH ACADEMY OF TECHNICAL SCIENCES, COPENHAGEN.
Space research in Denmark N79-24937
DEFENCE RESEARCH INFORMATION CENTRE, ORPINGTON [ENGLAND].
Bolted joint fatigue programme. Volume 1. Stage 1, sections 1 to 6
[AD-A064080] N79-24380
Observations on the physico-chemical forms of cobalt, manganese, zinc, chromium and iron in sea water enriched or not with organic matter
[DRIC-TRANS-5370] N79-24625
DEFENSE COMMUNICATIONS ENGINEERING CENTER, RESTON, VA.
Priority loss systems: Unequal holding times
[AD-A066245] N79-24239
Overview of timing/synchronization for digital communications N79-24746
DENVER RESEARCH INST., COLO.
Balloon-borne particulate sampling for monitoring power plant emissions
[PB-290473/8] N79-24543
DENVER UNIV., COLO.
Direct methods for seismic profiling
[COO-2482-9] N79-24588
DEPARTMENT OF ENERGY, BARTLESVILLE, OKLA.
Stability characteristics of hydrocarbon fuels from alternative sources
[BETC/RI-78/23] N79-24178
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[BETC/PPS-79/1] N79-24189
DEPARTMENT OF ENERGY, WASHINGTON, D. C.
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[NASA-TM-80354] N79-24435
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[DOE/US-002] N79-24490
Electric and hybrid vehicle program
[DOE/CS-0068] N79-24900
DEUTSCHER WETTERDIENST, OFFENBACH AM MAIN [WEST GERMANY].
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Reports from the German Meteorological Service. Number 145: The tensor structure of constitutive equations for linear atmospheric heat and momentum exchange with axisymmetric coefficients
[ISBN-3-88184-158-3] N79-24607
DOW CORNING CORP., MIDLAND, MICH.
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
DREXEL UNIV., PHILADELPHIA, PA.
Modeling and verification of heat pump performance for industrial energy conservation N79-24293
DU PONT DE NEMOURS [E. I.] AND CO., AIKEN, S. C.
Land application studies of industrial waste oils and solvents
[DP-MS-78-55] N79-24524
Method for using acoustic sounder categories to determine atmospheric stability
[DP-MS-78-49] N79-24618
Studies for geologic storage of radioactive waste in the southeast
[DP-MS-78-26] N79-24816

E

EAGLE-PICHER INDUSTRIES, INC., MIAMI, OKLA.
Study program to develop and evaluate die and container materials for the growth of silicon ribbons
[NASA-CR-158543] N79-24470

EASTERN ENVIRONMENTAL RADIATION LAB., MONTGOMERY, ALA.
A radiological environs study at a fuel fabrication facility
[PB-291928/0] N79-24530
ECOLE NATIONALE SUPERIEURE DE CHIMIE DE PARIS [FRANCE].
Quartz crystal and superconductive resonators and oscillators
N79-24737
EDGERTON, GERMESHAUSEN AND GRIER, INC., ALBUQUERQUE, N.MEX.
Performance testing of the McDonnell Douglas fresnel lens solar collector
[SAND-78-0625] N79-24512
EFRATOM SYSTEMS CORP., IRVINE, CALIF.
Elimination of the light shift in rubidium gas cell frequency standards using pulsed optical pumping
N79-24739
EIC, INC., NEWTON, MASS.
Energy storage with ambient temperature rechargeable lithium batteries
[PB-290934/9] N79-24518
EMMANUEL COLL., BOSTON, MASS.
Study and analysis of equatorial irregularities, total electron content, and scintillations
[AD-A065550] N79-24577
Investigation of micropulsation activity
[AD-A066344] N79-24668
ENERGY SYSTEMS INTERNATIONAL, MCLEAN, VA.
Solar energy commercialization for European countries, volume 2
[HCP/CS-4250-VOL-2] N79-24493
ENGINEERING SCIENCES DATA UNIT, LONDON [ENGLAND].
Grease life estimation in rolling bearings
[ESDU-78032] N79-24344
Contact phenomena. 1: Stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components
[ESDU-78035] N79-24369
ENVIRONMENTAL PROTECTION AGENCY, ANN ARBOR, MICH.
Exhaust emissions and fuel economy from automobiles using alcohol/gasoline blends under high-altitude conditions
[PB-290612/1] N79-24191
Gasohol test program
[PB-290569/3] N79-24193
ENVIRONMENTAL PROTECTION AGENCY, RESEARCH TRIANGLE PARK, N.C.
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527
Control of volatile organic emissions from petroleum liquid storage in external floating roof tanks
[PB-290579/2] N79-24537
ENVIRONMENTAL PROTECTION AGENCY, SEATTLE, WASH.
Carbon monoxide study, Seattle, Washington, part 1
[PB-290505/7] N79-24528
Carbon monoxide study, Seattle, Washington, part 2
[PB-290506/5] N79-24529
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D. C.
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[PB-290742/6] N79-24911
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[E79-10197] N79-24416
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Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Evaluation and analysis of Seasat-A scanning multichannel Microwave Radiometer [SMMR] Antenna Pattern Correction [APC] algorithm
[NASA-CR-158674] N79-24420
EUROPEAN SPACE AGENCY, PARIS [FRANCE].
Effects of electron irradiation on large insulating surfaces used for European Communications Satellites
N79-24036
The Qualification of a large electron irradiation facility for telecommunication satellite differential charging simulation
N79-24052
EUROPEAN SPACE RESEARCH AND TECHNOLOGY CENTER, NOORDWIJK [NETHERLANDS].
Investigation of electrostatic discharge phenomena on conductive and non-conductive solar reflectors
N79-24043
EXXON RESEARCH AND ENGINEERING CO., LINDEN, N. J.
State-of-the-art study of land and impoundment techniques
[PB-291881/1] N79-24908

F

FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D. C.
Investigation of methods for converting the FCC ground wave field intensity curves to the metric system
[PB-290930/7] N79-24250
An automated retrieval system for frequency allocation information
[PB-291600/5] N79-24251
FERN ENGINEERING CO., BUZZARDS BAY, MASS.
Test and evaluation of Fern Engineering Company, Incorporated, solar heating and hot water system
[NASA-CR-161191] N79-24438
FLORIDA STATE UNIV., TALLAHASSEE.
F-normed ideals of spaces of measurable functions
N79-24686
FLORIDA UNIV., GAINESVILLE.
High-temperature series expansion for the singlet-triplet model
N79-24864
Superconducting and normal state properties of hexagonal cesium tungsten bronze
N79-24865
FLUOR ENGINEERS AND CONSTRUCTORS, INC., IRVINE, CALIF.
Conceptual design for advanced coal liquefaction commercial plant
[FE-2251-52] N79-24182
FORDHAM UNIV., NEW YORK, N. Y.
Structure analyses of organic compounds using X-ray crystallographic techniques
N79-24851
FORSCHUNGSINSTITUT FUER ANTHROPOTECHNIK, MECKENHEIM [WEST GERMANY].
Analytical methods for biotechnological design of man machine systems: Work on system ergonomy
[FB-28] N79-24315
A two level model of human steering behavior in a motor vehicle
[FB-27] N79-24657
FORSCHUNGSINSTITUT FUER HOCHFREQUENZPHYSIK, WERTHHOVEN [WEST GERMANY].
SABAB: A program for calculating satellite ephemerides
[REPT-10-78] N79-23993
The theory of spectrum analysis of stochastic processes
[REPT-0-78] N79-24109
Considerations concerning detection of non-cooperative illuminated targets
[REPT-2-78] N79-24245
Detection of low flying aircraft by acoustical means
[REPT-8-78] N79-24779
FREQUENCY AND TIME SYSTEMS, INC., DANVERS, MASS.
Acceleration sensitivity compensation in high performance crystal oscillators
N79-24735
Performance of preproduction model cesium beam frequency standards for spacecraft applications
N79-24740

G

GEIRINGER [PAUL L.] AND ASSOCIATES, ROSLYN, N. Y.
Community application of integrated energy/utility systems
[PB-290675/8] N79-24520
GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
The NAVSTAR global positioning system: A program with many uncertainties
[PB-291438/0] N79-23944
US refining capacity: How much is enough
[PB-291437/2] N79-24192
Developing a domestic common carrier telecommunications policy: What are the issues
[PB-290787/1] N79-24249
Hazardous waste management problems will not be effective: Greater efforts are needed
[PB-291622/9] N79-24907
GENERAL DYNAMICS/FORT WORTH, TEX.
Energy maneuverability display validation
[AFFDL-TR-78-35-VOL-1] N79-23947
GENERAL ELECTRIC CO., CINCINNATI, OHIO.
Fabrication of J79 boron/aluminum compressor blades
[NASA-CR-159566] N79-23970
Turbine design system
[AD-A066092] N79-23974
GENERAL ELECTRIC CO., DAYTONA BEACH, FLA.
Computer image generation: Improved edge utilization study
[AD-A065640] N79-24673
GENERAL ELECTRIC CO., EVENDALE, OHIO.
Materials and techniques for spacecraft static charge control 2
N79-24034
GENERAL ELECTRIC CO., HOUSTON, TEX.
Fluid and Electrolyte Balance model [FEB]
[NASA-CR-160206] N79-24633
Validation of a model for investigating red cell mass changes during weightlessness
[NASA-CR-160188] N79-24634
User's instructions for the Grodins' respiratory control model using the UNIVAC 1110 remote batch and demand processing
[NASA-CR-160225] N79-24635
A long term model of circulation
[NASA-CR-147674] N79-24636
Transient thermoregulatory model with graphics output
[NASA-CR-160217] N79-24637
User's instructions for the 41-node thermoregulatory model [steady state version]
[NASA-CR-160220] N79-24638
Evaluation of exercise-respiratory system modifications and preliminary respiratory-circulatory system integration scheme
[NASA-CR-160221] N79-24639
Acid-base homeostasis in the human system
[NASA-CR-12932] N79-24640
Design specification for the whole-body algorithm
[NASA-CR-160226] N79-24641
Systems identification and application systems development for monitoring the physiological and health status of crewmen in space
[NASA-CR-160235] N79-24642
Physiological system integrations with emphasis on the respiratory-cardiovascular system
[NASA-CR-160230] N79-24643
Study report on combining diagnostic and therapeutic considerations with subsystem and whole-body simulation
[NASA-CR-160231] N79-24644
The application of sensitivity analysis to models of large scale physiological systems
[NASA-CR-160228] N79-24645
GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Standard test rack. Concept definition study. Structural analysis report
[AD-A066247] N79-23998
Spacecraft charging results for the DSCS-3 satellite
N79-24014
GENERAL ELECTRIC CO., PITTSFIELD, MASS.
Electrical characterization of linear integrated circuits
[AD-A065997] N79-24268
GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
Evaluation of a flywheel-powered shuttle car
[FE-8890] N79-24488
Advanced archival memory
[AD-A066298] N79-24667
Design, fabrication, and delivery of a charge injection device as a stellar tracking device
[NASA-CR-161226] N79-24919
GEOPHYSICAL OBSERVATORY, CHRISTCHURCH [NEW ZEALAND].
A suite of programs for handling ionospheric data
[PEL-REPORT-628] N79-24566
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Program in acoustics
[NASA-CR-158660] N79-24771
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[MPIS-16/1977] N79-24134
GRENOBLE UNIV. [FRANCE].
Measurements of coherence in ELF emission between sets of conjugate points
[CEPHAG-37/77] N79-24240
Spectral analysis by means of autoregressive filter
[CEPHAG-41/77] N79-24241
Study of the influence of negative ions on the incoherent scattering spectra
[CEPHAG-45/77] N79-24242
Comparative study of phase curves obtained by different methods for estimating cross spectral density. Geographic applications: Measure of phase shift and delay of PC 1 signals
[CEPHAG-4/78] N79-24243
Internal and external models of variable parameter filters
[CEPHAG-44/77] N79-24777

Optimal detection in the presence of reverberation: Study and discussion of the stationary case
[CEPHAG-48/77] N79-24778
GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
Environmental interaction implications for large space systems
N79-24027
Parameter dependence of equilibrium charging potentials
N79-24045
Design, fabrication and test of a hydrogen heat pipe
[NASA-CR-152267] N79-24298
GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.
New polymeric membranes containing phosphonate ester groups for water desalination
[PB-290609/7] N79-24110

H

HAMBURG UNIV. [WEST GERMANY].
Results of the geoscientific investigations from the VALDIVA cruise VA-10/1975 off Western Africa
[BMFT-FB-M-78-03] N79-24592
HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH.
Effects of irradiation and thermal aging upon fatigue-crack growth behavior of reactor pressure boundary materials
[HEDL-SA-1663] N79-24133
HARRIS CORP., MELBOURNE, FLA.
An Evaluation of optional timing/synchronization features to support selection of an optimum design for the DCS digital communication network
N79-24748
Effect of various features on the life cycle cost of the timing/synchronization subsystem of the DCS digital communications network
N79-24749
Array scanning for image transmission
[AD-A065583] N79-24825
HARVARD UNIV., CAMBRIDGE, MASS.
Spectroscopic investigations of metal cation reduction at glass surfaces
N79-24079
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376
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HEWLETT-PACKARD CO., SANTA CLARA, CALIF.
Frequency domain measurement systems
N79-24744
HIRAM COLL., OHIO.
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N79-24049
HONEYWELL CORPORATE MATERIAL SCIENCES CENTER, BLOOMINGTON, MINN.
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[NASA-CR-158669] N79-24453
HONEYWELL, INC., ST. PETERSBURG, FLA.
Manufacturing methods and technology engineering for tape chip carrier
[AD-A065890] N79-24270
HOUSTON UNIV., TEX.
Operator performance and localized muscle fatigue in a simulated space vehicle control
N79-24653
Microstructural study of V2D by X-ray measurements
N79-24854
HSS, INC., BEDFORD, MASS.
EOMET-77: Atmospheric transmission values derived from photographs of the sea horizon
[AD-A065942] N79-24576
HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
High energy resonance transfer laser study
[AD-A065926] N79-24333
HUGHES AIRCRAFT CO., FULLERTON, CALIF.
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[AD-A065566] N79-24774
HUGHES RESEARCH LABS., MALIBU, CALIF.
High energy proton radiation damage to [AlGa]As-GaAs solar cells
[NASA-CR-3148] N79-24261
HYDRAULIC RESEARCH TEXTRON, VALENCIA, CALIF.
An electric control for an electrohydraulic active control aircraft landing gear
[NASA-CR-3113] N79-23948

I

IIT RESEARCH INST., CHICAGO, ILL.
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[AD-A062491] N79-24128
ILLINOIS INST. OF NATURAL RESOURCES, CHICAGO.
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[PB-290916/6] N79-24541
ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
On the correlation of the kinetics of electron transfer processes with the change in reaction free energy. Application to electron-exchange initiated chemiluminescence reactions
[AD-A066342] N79-24105
Investigation of electromagnetic coupling through single or multiple apertures into cylindrical structures
[AD-A065585] N79-24226
ILLINOIS UNIV. AT URBANA-CHAMPAIGN, URBANA.
An investigation on characterizing mutual coupling between tow antenna slots on a cone
[AD-A066330] N79-24234
Asymptotic stability of a class of nonlinear singularly perturbed systems
[AD-A062957] N79-24701
Multi-Regge factorization in inclusive two-particle production
[ILL-[TH]-79-14] N79-24793
ILLINOIS UNIV., URBANA.
A rocket-borne electrostatic analyzer for measurement of energetic particle flux
[NASA-CR-158646] N79-24569
A rocket-borne pulse-height analyzer for energetic particle measurements
[NASA-CR-158645] N79-24570
A rocket-borne data-manipulation experiment using a microprocessor
[NASA-CR-158647] N79-24571
Operating manual for the RRL 8 channel data logger
[NASA-CR-158633] N79-24671
INDIANA UNIV. AT BLOOMINGTON.
Comparison of atomic fluorescence power efficiencies for the helium-oxygen-acetylene and air-acetylene flames
[AD-A066083] N79-24100
A theoretical study into the spatial distribution of atoms surrounding an individual solute particle vaporizing in an analytical flame
[AD-A066182] N79-24796
Measurement and comparison of relative free-atom fractions in the helium-oxygen-acetylene and air-acetylene flames
[AD-A066153] N79-24797
INDIANA UNIV., BLOOMINGTON.
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N79-24922
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.
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[FE-2434-29] N79-24184
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Solar project cost report: Radian Corporation Office Building, Austin, Texas
[SOLAR/2002-78/60] N79-24480
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[SOLAR/2003-78/50] N79-24481
Solar project cost report: Scattergood School Recreation Center, West Branch, Iowa
[SOLAR/2003-78/60] N79-24482
Solar project cost report: Terrell E. Moseley Office Building, Lynchburg, Virginia
[SOLAR/2011-78/60] N79-24483
Solar project cost report: Kalwall Corporation Warehouse, Manchester, New Hampshire
[SOLAR/2015-78/60] N79-24484
Solar project description: Aratex Services, Incorporated, industrial laundry, Fresno, California
[SOLAR/2008-78/50] N79-24485
Solar project description: Iris Images, Incorported, film laboratory, Mill Valley, California
[SOLAR/2005-78/50] N79-24486
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[SOLAR/2005-78/60] N79-24494
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[SOLAR/2008-78/60] N79-24495
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[SOLAR/2002-78/50] N79-24496
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[SOLAR/0012-78/29] N79-24497
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[SOLAR/2011-78/50] N79-24498
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[SOLAR/2015-78/50] N79-24499
INTERNATIONAL LASER SYSTEMS, INC., ORLANDO, FLA.
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[NASA-CR-159932] N79-24329
INTERNATIONAL LATITUDE OBSERVATORY, MIZUSAWA [JAPAN].
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N79-24752
INTERNATIONAL METEOROLOGICAL INST., STOCKHOLM [SWEDEN].
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[AC-46] N79-24525
Activities of the International Meteorological Institute
[AR-77-78] N79-24590
A mixed layer model of wind and density driven mixing during a phytoplankton bloom
[DM-24] N79-24619
IOWA INST. OF HYDRAULIC RESEARCH, IOWA CITY.
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[PB-290576/8] N79-24515
IOWA UNIV., IOWA CITY.
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[AD-A065935] N79-23949
Fail-safe optimal design of structures with substructuring
[AD-A065936] N79-23950
Dynamic structural analysis with substructures
[AD-A065937] N79-24378

J

JAYCOR, DEL MAR, CALIF.
Model for breakdown process in dielectric discharges
N79-24044
JET PROPULSION LAB., CALIF. INST. OF TECH., PASADENA.
Electrostatic discharge properties of selected Voyager spacecraft materials
N79-24039
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Phase conjugation method and apparatus for an active retrodirective antenna array
[NASA-CASE-NPO-13641-1] N79-24210
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Evaluation and analysis of Seasat-A Scanning multichannel Microwave radiometer [SMMR] Antenna Pattern Correction [APC] algorith. Sub-task 2: T sub B measured us. T sub B calculated comparison results
[NASA-CR-158540] N79-24213
Module failure isolation circuit for paralleled inverters
[NASA-CASE-NPO-14000-1] N79-24254
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257
Proceedings of the distribution automation and control working group. Volume 1: Executive summary
[NASA-CR-158642] N79-24259
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431
Primary reflector for solar energy collection systems and method of making same
[NASA-CASE-NPO-13579-3] N79-24432
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452
Low-cost Solar Array [LSA] project
[NASA-CR-158650] N79-24457
Low-cost Solar Array [LSA] project
[NASA-CR-158651] N79-24458
LSA: Low-cost Solar Array project
[NASA-CR-158533] N79-24459
Thermal Storage Applications Workshop. Volume 1: Plenary Session Analysis
[NASA-CR-158643] N79-24460
Thermal Storage Applications Workshop. Volume 2: Contributed Papers
[NASA-CR-158644] N79-24461
Thermal power systems, small power systems application project. Volume 1: Executive summary
[NASA-CR-157441] N79-24462

High-efficiency thin-film GaAs solar cells
[NASA-CR-158641] N79-24463
Thermal power systems, point-focusing distributed receiver technology project. Volume 2: Detailed report
[NASA-CR-158534] N79-24464
The parabolic concentrating collector: A tutorial
[NASA-CR-158639] N79-24465
HEAP: Heat Energy Analysis Program, a computer model simulating solar receivers
[NASA-CR-158640] N79-24466
The array automated assembly task for the low cost solar array project, phase 2
[NASA-CR-158538] N79-24469
Develop silicone encapsulation systems for terrestrial silicon solar arrays
[NASA-CR-158537] N79-24471
Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646
Compact artificial hand
[NASA-CASE-NPO-13906-1] N79-24652
PTTI applications to deep space navigation N79-24759

JOINT CENTER FOR GRADUATE STUDY, RICHLAND, WASH.
Investigation of low cost solar cells based on Cu2O
[PB-290940/6] N79-24516

JOINT PUBLICATIONS RESEARCH SERVICE, ARLINGTON, VA.
Translations on Eastern Europe: Scientific affairs, no. 627
[JPRS-73404] N79-23990
Polish Interkosmos participation described N79-23991
Translations on Eastern Europe: Scientific affairs, no. 625
[JPRS-73266] N79-24938
Experiments of USSR-CSSR cosmic flight described N79-24939
Application of electron-beam welding to aviation production N79-24940
Translations on USSR science and technology: Physical sciences and technology, no. 66
[JPRS-73337] N79-24941
Microprocessors and LSI microprocessor sets as the component base of modern digital systems N79-24942
Bipolar dynamic memory cells N79-24943
Tokamak physics: The 70th birthday of L. A. Artsimovich [25 February 1909 to 1 March 1973] N79-24944
Channeling of charged particles N79-24945
Translations on USSR science and technology: Physical sciences and technology, no. 67
[JPRS-73388] N79-24946
Production, utilization of computer technology in national economy N79-24947
Research shows ways to facilitate introduction of ASU's N79-24948
Power industry application of MHD technology N79-24949

JRB ASSOCIATES, MCLEAN, VA.
Office of Research and Development program guide, fiscal year 1979
[PB-292003/1] N79-24912

K

KAMAN AEROSPACE CORP., BLOOMFIELD, CONN.
Driveshaft alignment indicator
[AD-A065988] N79-23973

KAMAN AVIDYNE, BURLINGTON, MASS.
NOVA-2S, a stiffened panel extension of the NOVA-2 computer program
[AD-A066038] N79-23951

KANSAS UNIV., LAWRENCE.
High temperature thermodynamics and vaporization of the zirconium-niobium-oxygen system N79-24075
Comparison of three experimental methods used in determining the thermal performance of flat-plate solar collectors N79-24434
Temporal and spatial distribution of humidity in a small city N79-24599
Anomalous ionic conductivity in silver bromide and silver chloride N79-24857

KENT STATE UNIV., OHIO.
Divergence of the bend curvature coefficient above the nematic-smectic A phase transition: Freedericksz transition N79-24788
A test of curvature elasticity above the nematic-smectic A phase transition N79-24859

L

LABORATOIRES D'ELECTRONIQUE ET DE PHYSIQUE APPLIQUEE, LIMEIL-BREVANNES [FRANCE].
Microscopic study of the gas-solid interface during the vapor phase of epitaxy
[LEP-77/9.SME-618-B] N79-24108
Characterization and growth of epitaxial layers of GaAs exhibiting high resistivity for ionic implantation
[LEP-78/19.SME-441-H] N79-24881

LABORATORIUM FUER BETRIEBSFESTIGKEIT, DARMSTADT [WEST GERMANY].
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 1
[LBF-TB-111-VOL-1] N79-24400
Determination of the fatigue strength of welded joints on AlZnMg 1 based on local strain measurements, volume 2
[LFB-TB-112-VOL-2] N79-24401
A method for deriving statistical parameters for design against random stresses resulting from working operations
[LFB-FB-135] N79-24402

LAVAL UNIV. [QUEBEC].
Time domain measurement of frequency stability: A tutorial introduction N79-24741

LEHIGH UNIV., BETHLEHEM, PA.
Development of a modular software system for the dynamic simulation of coal conversion plants
[FE-2338-10] N79-24176

LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Target detection with a direct-reception optical radar
[AD-A065627] N79-24221
The monopulse performance of an optical heterodyne detector with varying LO distributions
[AD-A066253] N79-24238
Seismic discrimination
[AD-A065574] N79-24578
Local site distortion model of magnetostriction
[AD-A066250] N79-24763

LISTER HILL NATIONAL CENTER FOR BIOMEDICAL COMMUNICATIONS, BETHESDA, MD.
LHC-PILOT, user guide
[PB-291985/0] N79-24676
LHC-PILOT, system guide
[PB-291986/8] N79-24677

LITTLE [ARTHUR D.], INC., CAMBRIDGE, MASS.
Flame arrestor design requirements for prolonged exposure to methane/air and gasoline/air flames
[AD-A063002] N79-24104

LITTON SYSTEMS, INC., VAN NUYS, CALIF.
Multimode CPU design study
[AD-A066241] N79-24666

LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
Nationwide forestry applications program. Ten-Ecosystem Study [TES] site 8, Grays Harbor County, Washington
[E79-10191] N79-24411
Program documentation. Program description and user information for the hydraulics/auxiliary power unit [HYDRA] computer program
[NASA-CR-160178] N79-24672
Learning with imperfectly labeled patterns
[NASA-CR-160183] N79-24697

LOCKHEED MISSILES AND SPACE CO., HUNTSVILLE, ALA.
Thermal and fluid flow analyses of sounding rocket experiment 74-21/2R and 74-21/3R
[NASA-CR-161224] N79-24295

LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Low-energy particle experiment
[AD-A066150] N79-24840
Analysis of time dependent phenomena observed with the LPSP OSO-8 instrument
[NASA-CR-161233] N79-24932

LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.
OTEC platform configuration and integration study. Volume 2: Technical concept
[DOE/ET-4063-1-VOL-2] N79-24477

LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Treatment of molybdenite ore using a 2 kW solar furnace
[LA-UR-79-6] N79-24478
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7694-PR] N79-24801
Stability and degradation of superconducting current-carrying devices
[LA-7275] N79-24879

LOUISIANA STATE UNIV., BATON ROUGE.
Preliminary long-term stability criteria for compressed air energy storage caverns in salt domes
[PNL-2871] N79-24487

LOUISIANA STATE UNIV. AND A&M COLL., BATON ROUGE.
Transport properties of binary mixtures of dense hard-sphere fluids N79-24291
Construction of integral quadratic forms N79-24691

LOUISVILLE UNIV., KY.
Factors influencing Seebeck effect of thin tellurium films N79-24860

M

MAGNETIC OBSERVATORY, HERMANUS [SOUTH AFRICA].
Studies in ionospheric ray tracing
[CSIR-R-MAG-5/17] N79-24573

MAINE UNIV., ORONO.
Effect of soil moisture content upon adsorption and movement of phosphorus from leachates of domestic waste disposal systems
[PB-290561/0] N79-24536

MARQUARDT CORP., VAN NUYS, CALIF.
Bistable [latching] solenoid actuated propellant isolation valve
[NASA-CR-158673] N79-24352

MARTIN MARIETTA AEROSPACE, ORLANDO, FLA.
Reliability trade-offs for unit production cost
[AD-A065643] N79-24360

MARTIN MARIETTA LABS., BALTIMORE, MD.
Petrographic and petrological studies of lunar rocks
[NASA-CR-159921] N79-24929

MARYLAND UNIV., COLLEGE PARK.
Photoelastic studies of crack propagation and arrest in polymers and 4340 steel
[PB-291508/0] N79-24141
Time-of-flight technique for particle identification at energies from 2 to 400 keV/nucleon
[NASA-CR-158611] N79-24792
Observations and interpretations of magnetic-field-line reconnection and tearing in a Theta Pinch
[PL-79-022] N79-24838
Guides for undertaking a neighborhood transportation needs assessment: Users manual
[PB-290589/1] N79-24909
Urban transportation and neighborhood preservation
[PB-290590/9] N79-24910
Compositions of energetic particle populations in interplanetary space
[NASA-CR-158621] N79-24935

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Length and bursting of separation bubbles: A physical interpretation N79-23898
Design of propellers for motorsoarers N79-23903
Routing to minimize the maximum congestion in a communication network
[AD-A066110] N79-24225
Communication complexity of distributed shortest path algorithms
[AD-A066152] N79-24237
Turbulent boundary layer structure and drag reduction
[AD-A065667] N79-24303
Robust stability of linear systems: Some computational considerations
[NASA-CR-158620] N79-24695
Down to earth relativity N79-24753

MATERIALS RESEARCH LABS., ASCOT VALE [AUSTRALIA].
Electrodeposition painting of metal substrates: Pinholing in surface films
[AD-A065968] N79-24160
The combustion of organic polymeric materials. Ignition properties
[AD-A065967] N79-24162

MAX-PLANCK-INSTITUT FUER PHYSIK UND ASTROPHYSIK, GARCHING [WEST GERMANY].
Scattering of Li ions on nickel single crystal planes in the 10-50eV energy range: Experiment and computer simulation
[MPIS-16/1977] N79-24134
Measurements of the differential scattering cross sections of electron excited Na on Hg
[MPIS-13/1977] N79-24804
Research activities of the Institute of Extraterrestrial Physics
[MPI-PAE-EXTRATERR-141] N79-24936

MAX-PLANCK-INSTITUT FUER STROEMUNGSFORSCHUNG, GOETTINGEN [WEST GERMANY].
On the reaction between O-H-D-B-r-Cl atoms with vibrationally excited HCl
[MPIS-19/1977] N79-24805

MCDONNELL AIRCRAFT CO., ST. LOUIS, MO.
Definition and non-destructive detection of critical adhesive bond-line flaws
[AD-A065584] N79-24163
MECHANICAL TECHNOLOGY, INC., LATHAM, N. Y.
Investigation of magnetic fields and forces arising in closed- and open-circuit-type magnetic suspension systems
[AD-A065923] N79-24354
The balance of rollers for high DN bearings
[AD-A065899] N79-24356
Development of procedures for calculating stiffness and damping of elastomers in engineering applications. Part 5: Elastomer performance limits and the design and test of an elastomer damper
[NASA-CR-159552] N79-24373
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH [WEST GERMANY].
Evaluation of a digital helicopter control system
[MBB-UFE-1349-O] N79-23980
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., OTTOBRUNN [WEST GERMANY].
Development of an airborne military system [MRCA system]
[MBB-UFE-1322-O] N79-23904
Aerodynamic problems in engine airframe integration on fighter airplanes
[MBB-UFE-1359-O] N79-23936
Airfoil optimization for transonic flow using the methods of finite elements and characteristics
[MBB-UFE-1362-O] N79-23937
MESSERSCHMIDT-BOELKOW G.M.B.H., MUNICH [WEST GERMANY].
A finite element method for the computation of the transonic potential flow past airfoils
[MBB-UFE-1352-O] N79-23935
The time budget as a criterion for the workload of air traffic controllers
[MBB-UFE-1353-O] N79-23943
Flight-by-flight crack propagation test results with several load spectra and comparison with calculation according to different models
N79-24395
Human factors engineering research for Cabin Taxi [CAT]
[MBB-UFE-1355-O] N79-24901
METEOROLOGISCHES OBSERVATORIUM, HOHENPEISSENBERG [WEST GERMANY].
Results of aerial and surface ozone measurements during the second half of 1977
[SONDERBEOB-36] N79-24591
MIAMI UNIV., CORAL GABLES, FLA.
Deep ocean reception of acoustic signals emitted by a towed source
N79-24766
MICHIGAN STATE UNIV., EAST LANSING.
Computational design alternatives with microprocessor-based systems
N79-24664
MICHIGAN UNIV., ANN ARBOR.
Improved ultrasonic nondestructive testing of pressure vessels
[NUREG-CR-0581] N79-24361
MIDWEST RESEARCH INST., GOLDEN, COLO.
Densified biomass: A new form of solid fuel
[SERI-35] N79-24180
MISSION RESEARCH CORP., SANTA BARBARA, CALIF.
Skynet satellite electron precharging experiments
N79-24037
Comparison of signal scintillation models
[AD-A066102] N79-24227
MISSISSIPPI STATE UNIV., STATE COLLEGE.
Numerical solution of the two-dimensional non-steady mean Navier-Stokes equations for incompressible flows past arbitrary shaped bodies
N79-23905
Feedback communications using coding in the forward link
N79-24209
Numerical solution of Navier-Stokes equations for wide range of two dimensional incompressible internal flow problems using boundary-fitted curvilinear coordinates
N79-24290
MISSISSIPPI UNIV., JACKSON.
A long term model of circulation
[NASA-CR-147674] N79-24636
MISSISSIPPI UNIV., UNIVERSITY.
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
N79-24204
MISSOURI UNIV. -ROLLA.
Kinetic reaction coefficients in rocket exhaust plumes
[AD-A065646] N79-24059
Continuum absorption coefficient of atoms and ions
[NASA-CR-158536] N79-24791
MITRE CORP., MCLEAN, VA.
The impact of telecommunication on transportation demand through the year 2000
[PB-290833/3] N79-24246
Microwave remote sensing laboratory design
[NASA-CR-159015] N79-24419
MOBIL RESEARCH AND DEVELOPMENT CORP., PAULSBORO, N. J.
Fluid bed process studies on selective conversion of methanol to high octane gasoline
[FE-2490-15] N79-24190
MONTPELLIER UNIV. [FRANCE].
Relationship between Dirac and matrix Schroedinger inverse scattering transforms
[PM/78/6] N79-24072
Spectral and scattering inverse problems
[PM/78/4] N79-24244
Spectral and scattering inverse problems
[PM/78/1] N79-24394
Nonlinear evolution equations associated with a massive Dirac system
[PM/78/5] N79-24705
Unitarity constraints on meson-nucleon helicity-flip amplitudes and slope of the diffraction peak
[PM/78/7] N79-24802
Weak interaction effects in electron positron yields 2 photons
[PM/78/8] N79-24803
MOTOROLA, INC., PHOENIX, ARIZ.
Transistor screening evaluation SJ6708H
[NASA-CR-161234] N79-24258
Laser-zone growth in a Ribbon-to-Ribbon [RTR] process silicon sheet growth development for the large area silicon sheet task of the low cost solar array project
[NASA-CR-158570] N79-24473
MOUND LAB., MIAMISBURG, OHIO.
Proposed implementation of laser Raman scattering spectroscopy for analysis of hydrogen isotopes
[MLM-2583] N79-24107
Chemical and optical studies of heat transfer fluids containing solar energy absorbers
[MLM-2549[OP]] N79-24505

N

NAGOYA UNIV. [JAPAN].
Anomalous plasma transport due to electron temperature gradient instability
[IPPJ-369] N79-24833
Collisionless tearing instabilities
[IPPJ-370] N79-24834
Space- and time-resolved study of impurities by visible spectroscopy in high density regime of JIPP T-2 Tokamak plasma
[IPPJ-374] N79-24835
Stabilization of magnetohydrodynamic instabilities in a current-carrying stellarator
[IPPJ-368] N79-24836
Propagation of ion acoustic cnoidal wave
[IPPJ-367] N79-24837
Characteristics of fast response InSb submillimeter detector
[IPPJ-T-31] N79-24839
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Aerodynamics
[NASA-TT-F-765] N79-23908
Approximation theory for boundary layer suction through individual slits
[NASA-TM-75384] N79-23910
Aircraft icing: Introduction
N79-23913
Apollo 11: A good ending to a bad decade
[NASA-NEWS-RELEASE-79-73] N79-23986
Preliminary results of the determination of the orientation of Interkosmos-17 AUOS
[NASA-TM-75613] N79-23994
Evolution of the rotation of an artificial earth satellite under the influence of a perturbing moment which is constant in fixed axes
[NASA-TM-75614] N79-23995
Crack barriers improve the mechanical and thermal properties of non-metallic sinter materials
[NASA-TM-75426] N79-24065
Investigation of medium and high temperature phase change materials
[NASA-TM-75398] N79-24097
Hot-wire and hot-film anemometry
[NASA-TM-75413] N79-24323
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 1: Executive summary
[NASA-TM-80354] N79-24435
Preliminary environmental assessment for the Satellite Power System [SPS]. Volume 2: Detailed assessment
[NASA-TM-80355] N79-24436
Solar technology in the Federal Republic of Germany
[NASA-TM-75634] N79-24439
Global distribution of ozone for various seasons
[NASA-TM-75435] N79-24564
Anomaly of the composition of the F-2 equatorial region of the ionosphere during the hours after sunset according to data from the mass-spectrometer experiment on the Cosmos-274
[NASA-TM-75615] N79-24565
Medical science in Siberia: Oxygen exchange in the Far North
[NASA-TM-75391] N79-24630
Investigations about the quantitative changes of carbon dioxide production in humans. Report 2: Carbon dioxide production during fever and its relationship with heat production
[NASA-TM-75452] N79-24632
On isochronous derivatives of the first and second order in space dynamics tasks
[NASA-TM-75617] N79-24694
A contemporary approach to the problem of determining physical parameters according to the results of measurements
[NASA-TM-75616] N79-24696
Significant characteristics of social response to noise and vibration
[NASA-TM-75412] N79-24888
Heliostat for astronomical usage
[NASA-TM-75481] N79-24920
Fluctuations in microwave background radiation due to secondary ionization of the intergalactic gas in the universe
[NASA-TM-75619] N79-24934
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
An implicit algorithm for the conservative, transonic full-potential equation with effective rotated differencing
[NASA-TM-78570] N79-23909
An investigation of a full-scale rotor with four blade tip planform shapes
[NASA-TM-78580] N79-23922
Aircraft engine nozzle
[NASA-CASE-ARC-10977-1] N79-23971
A simplified rotor system mathematical model for piloted flight dynamics simulation
[NASA-TM-78575] N79-23977
Fibrous refractory composite insulation
[NASA-CASE-ARC-11169-1] N79-24062
New perfluoroalkyl polytriazines containing pendent iododifluoromethyl groups
[NASA-CASE-ARC-11241-1] N79-24153
Spacesuit mobility knee joints
[NASA-CASE-ARC-11058-2] N79-24651
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. HUGH L. DRYDEN FLIGHT RESEARCH CENTER, EDWARDS, CALIF.
Precision controllability of the F-15 airplane
[NASA-TM-72861] N79-23979
Flight test evaluation of an RAF high altitude partial pressure protective assembly
[NASA-TM-72864] N79-24654
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Summary of the two year NASA program for active control of ATS-5/6 environmental charging
N79-24006
Inductorless narrow-band filter/amplifier
[NASA-CASE-GSC-12410-1] N79-24260
A hydrological analysis of East Australian floods using Nimbus 5 electrically scanning microwave radiometer data
[NASA-TM-79689] N79-24421
Proceedings of the Tenth Annual Precise Time and Time Interval [PTTI] Applications and Planning Meeting
[NASA-TM-80250] N79-24731
A modular multiple use system for precise time and frequency measurement and distribution
N79-24742
Submicrosecond comparisons of time standards via the Navigation Technology Satellites [NTS]
N79-24756
Submicrosecond comparison of international clock synchronization by VLBI and the NTS satellite
N79-24757
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
Average plasma environment at geosynchronous orbit
N79-24004
Sheath effects observed on a 10 meter high voltage panel in simulated low earth orbit plasma
N79-24023
Fluid sample collection and distribution system
[NASA-CASE-MSC-16841-1] N79-24285
Large Area Crop Inventory Experiment [LACIE]. An overview of the Large Area Crop Inventory Experiment and the outlook for a satellite crop inventory
[E79-10193] N79-24413
The Large Area Crop Inventory Experiment [LACIE]. Methodology for area, yield and production estimation, results and perspective
[E79-10194] N79-24414
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.
Characteristics of the advanced supersonic technology AST-105-1 configured for transpacific

range with Pratt and Whitney aircraft variable stream control engines
[NASA-TM-78818] N79-23888
The science and technology of low speed and motorless flight, part 1
[NASA-CP-2085] N79-23889
An exploratory investigation of the effect of plastic coating on the profile drag of a practical-metal-construction sailplane airfoil
N79-23891
Further developments in simple total energy sensors
N79-23900
The application of microprocessor technology to in-flight computation
N79-23902
Electrochemical detection device
[NASA-CASE-LAR-11922-1] N79-24073
High-temperature microphone system
[NASA-CASE-LAR-12375-1] N79-24203
Vibration characteristics of walls and a plate glass window representative of those of a wood-frame house
[NASA-TP-1447] N79-24372
ATMOS Spacelab 1 science investigation
[NASA-TM-80465] N79-24568
Statistical comparisons of aircraft flyover noise adjustment procedures for different weather conditions
[NASA-TP-1430] N79-24773
Collisionless galaxy simulations
[NASA-RP-1037] N79-24921

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.
Theoretical fan velocity distortions due to inlets and nozzles
[NASA-TM-79150] N79-23911
Aircraft icing
[NASA-CP-2086] N79-23912
Executive summary of Aircraft Icing Specialists Workshop
N79-23914
An experimental investigation of forced mixing of a turbulent boundary layer in an annular diffuser
[NASA-TM-79171] N79-23920
Combined pressure and temperature distortion effects on internal flow of a turbofan engine
[NASA-TM-79136] N79-23963
Lean, premixed, prevaporized combustion for aircraft gas turbine engines
[NASA-TM-79148] N79-23964
Effect of degree of fuel vaporization upon emissions for a premixed prevaporized combustion system
[NASA-TM-79154] N79-23965
Effect of shocks on film cooling of a full scale turbojet exhaust nozzle having an external expansion surface
[NASA-TM-79157] N79-23966
Performance of two-stage fan with larger dampers on first-stage rotor
[NASA-TP-1399] N79-23967
Effects of steady-state pressure distortion on the stall margin of a J85-21 turbojet engine
[NASA-TM-79123] N79-23968
Effect of steady-state pressure distortion on flow characteristics entering a turbofan engine
[NASA-TM-79134] N79-23969
Communications technology satellite: United States experiments and disaster communications applications
[NASA-TM-79109] N79-23999
NASCAP modelling of high-voltage power system interactions with space charged-particle environments
[NASA-TM-79146] N79-24000
Spacecraft Charging Technology, 1978
[NASA-CP-2071] N79-24001
Summary of the two year NASA program for active control of ATS-5/6 environmental charging
N79-24006
The capabilities of the NASA charging analyzer program
N79-24011
Comparison of NASCAP predictions with experimental data
N79-24013
Interactions between spacecraft and the charged-particle environment
N79-24021
Plasma Interaction Experiment (PIX) flight results
N79-24022
Effect of parasitic plasma currents on solar-array power output
N79-24025
Status of materials characterization studies
N79-24030
Test results for electron beam charging of flexible insulators and composites
N79-24031
Area scaling investigations of charging phenomena
N79-24032
Charging rates of metal-dielectric structures
N79-24033
Polyimide prepreg material having improved tack retention
[NASA-CASE-LEW-12933-1] N79-24061
Ion beam sputter deposition of fluoropolymers
[NASA-CASE-LEW-13122-1] N79-24154
Diagnostics of wear in aeronautical systems
[NASA-TM-79185] N79-24350
Computer signal processing for ultrasonic attenuation and velocity measurements for material property characterizations
[NASA-TM-79180] N79-24359
Redox flow cell energy storage systems
[NASA-TM-79143] N79-24442
Description of photovoltaic village power systems in the United States and Africa
[NASA-TM-79149] N79-24443
Benefits of advanced technology in industrial cogeneration
[NASA-TM-79160] N79-24444
Redox flow cell development and demonstration project, calendar year 1977
[NASA-TM-79067] N79-24445
Performance optimization of an MHD generator with physical constraints
[NASA-TM-79172] N79-24446
An improved method for predicting the effects of flight on jet mixing noise
[NASA-TM-79155] N79-24770

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.
Magnetic shielding of large high-power-satellite solar arrays using internal currents
N79-24026
A programmable power processor for a 25-cW power module
[NASA-TM-78215] N79-24441

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.
Method and apparatus for producing concentric hollow spheres
[NASA-CASE-NPO-14596-1] N79-24197
Phase conjugation method and apparatus for an active retrodirective antenna array
[NASA-CASE-NPO-13641-1] N79-24210
A high-speed data link for moderate distances and noisy environments
[NASA-CASE-NPO-14152-1] N79-24212
Module failure isolation circuit for paralleled inverters
[NASA-CASE-NPO-14000-1] N79-24254
Circuit for automatic load sharing in parallel converter modules
[NASA-CASE-NPO-14056-1] N79-24257
Bonding machine for forming a solar array strip
[NASA-CASE-NPO-13652-2] N79-24431
Primary reflector for solar energy collection systems and method of making same
[NASA-CASE-NPO-13579-3] N79-24432
Solar energy collection system
[NASA-CASE-NPO-13579-2] N79-24433
Apparatus and method of inserting a microelectrode in body tissue or the like using vibration means
[NASA-CASE-NPO-13910-1] N79-24646
Compact artificial hand
[NASA-CASE-NPO-13906-1] N79-24652

NATIONAL AEROSPACE LAB., TOKYO (JAPAN).
Comparison of accuracies of solutions of linear shell theories for closed circular cylinders under edgewise loading
[NAL-TR-552T] N79-24370

NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
Antennas and the associated time domain range for the measurement of impulsive fields
[PB-291733/4] N79-24253
Dielectric measurements of five different soil textural types as functions of frequency and moisture content
[PB-291944/7] N79-24595
Composite oscillator systems for meeting user needs for time and frequency
N79-24733
Relationships between the performance of time/frequency standards and navigation/communication systems
N79-24734
Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes (CTS) satellite
N79-24755

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Measurement assurance for gage blocks
[PB-292020/5] N79-24200
Some thoughts on electrical connections
[PB-290491/0] N79-24282
Semiconductor measurement technology: Microelectronic Processing Laboratory at NBS
[PB-291790/4] N79-24283
Loose-particle detection in microelectronic devices
[PB-290679/0] N79-24284
Activities of the National Bureau of Standards nondestructive evaluation program for fiscal year 1978: Summary
[PB-291946/2] N79-24362
Proximity-vision system for protoflight manipulator arm
[NASA-CR-158652] N79-24658

NATIONAL GEODETIC SURVEY, ROCKVILLE, MD.
Modern methods for the determination of polar motion and UT1
N79-24754

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, WASHINGTON, D. C.
Automotive Fuel Economy Contractor's Coordination Meeting
[PB-290516/4] N79-24358

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Energy recovery from domestic refuse by means of incineration and pyrolysis
[CSIR-SR-WAT-54] N79-24468

NATIONAL MECHANICAL ENGINEERING RESEARCH INST., PRETORIA (SOUTH AFRICA).
The design, construction and calibration of a research cold room complex
[CSIR-ME-1577] N79-23983

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SILVER SPRING, MD.
Relative effective solar space heating over the United States obtained from southward-tilted solar collectors
[PB-292963/6] N79-24513

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D. C.
Report to the Congress on ocean dumping research
[PB-292791/1] N79-24913

NATIONAL PHYSICAL LAB., NEW DELHI (INDIA).
Clock synchronisation experiment in India using symphonie satellite
N79-24758

NATIONAL PHYSICAL RESEARCH LAB., PRETORIA (SOUTH AFRICA).
Using the ion microprobe mass analyser for trace element analysis
[CSIR-FIS-174] N79-24098

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO).
Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes (CTS) satellite
N79-24755

NATIONAL RESEARCH INST. FOR MATHEMATICAL SCIENCES, PRETORIA (SOUTH AFRICA).
Computer resource performance management A total data centre approach
[CSIR-TWISK-54] N79-24665
An impulse control policy for a class of jump diffusion processes
[CSIR-T-WISK-55] N79-24698

NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA.
Aircraft wake vortices. A bibliography with abstracts
[NTIS/PS-79/0166/3] N79-23939
Discrete address beacon system. A bibliography with abstracts
[NTIS/PS-79/0244/8] N79-23945
Aerospace computer systems. Part 1: Avionics applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0312/3] N79-23959
Aerospace computer systems. Part 1: Avionics applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0313/1] N79-23960
Aerospace computer systems. Part 2: Space and guided missile applications, volume 2. A bibliography with abstracts
[NTIS/PS-79/0314/9] N79-23961
Aerospace computer systems. Part 2: Space and guided missile applications, volume 3. A bibliography with abstracts
[NTIS/PS-79/0315/6] N79-23962
Hydrogen embrittlement of metals, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0177/0] N79-24135
Hydrogen embrittlement of metals, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/0178/8] N79-24136
Hydrogen embrittlement of metals, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0179/6] N79-24137
Hydrogen embrittlement of metals. Citations from the American Petroleum Institute data base
[NTIS/PS-79/0180/4] N79-24138
Superalloys, volume 2. Citations from the NTIS data base
[NTIS/PS-79/0220/8] N79-24139
Superalloys, volume 3. Citations from the Engineering Index data base
[NTIS/PS-79/0221/6] N79-24140
Corrosion of stainless steel, volume 2. A bibliography with abstracts
[NTIS/PS-79/0208/3] N79-24143
Aircraft sonic boom: Effects on buildings. A bibliography with abstracts
[NTIS/PS-79/0265/3] N79-24201
Electron beam semiconductor devices. Citations from the NTIS data base
[NTIS/PS-79/0142/4] N79-24280
Electron beam semiconductor devices. Citations from the Engineering Index data base
[NTIS/PS-79/0143/2] N79-24281

Heat pumps. Citations from the NTIS data base
[NTIS/PS-79/0232/3] N79-24316
Heat pumps, volume 1. Citations from the Engineering Index data base
[NTIS/PS-79/0233/1] N79-24317
Heat pumps, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/0234/9] N79-24318
Cavity flow, volume 2. A bibliography with abstracts
[NTIS/PS-79/0259/6] N79-24319
Stress crack phenomena volume 3. A bibliography with abstracts
[NTIS/PS-79/0269/5] N79-24403
Stress crack phenomena volume 4. A bibliography with abstracts
[NTIS/PS-79/0270/3] N79-24404
Instrumentation and data processing used in Earth Resources Technology Satellites (ERTS), volume 2. A bibliography with abstracts
[NTIS/PS-79/0206/7] N79-24430
Aircraft sonic boom: Biological effects. A bibliography with abstracts
[NTIS/PS-79/0190/3] N79-24650
Aircraft sonic boom: Studies on aircraft flight, aircraft design, and measurement. A bibliography with abstracts
[NTIS/PS-79/0264/6] N79-24780

NATIONAL TELECOMMUNICATION INFORMATION ADMINISTRATION, BOULDER, COLO.
Measurements of LF and MF radio propagation over irregular, inhomogeneous terrain
[PB-291732/6] N79-24247
Spectrum efficiency for multiple independent spread-spectrum land mobile radio systems
[PB-291539/5] N79-24248

NATIONAL TRANSPORTATION POLICY STUDY COMMISSION, WASHINGTON, D. C.
The impact of telecommunication on transportation demand through the year 2000
[PB-290833/3] N79-24246

NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON, D. C.
Safety hazard of aircraft icing
N79-23916

NAVAL ACADEMY, ANNAPOLIS, MD.
Preliminary investigation of the nonsteady combustion and flow processes of the Naval Academy Heat Balanced Engine [NAHBE]
[AD-A066085] N79-24101

NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
US Navy development of an On-Board Oxygen Generation [OBOG] system
[AD-A063958] N79-24656

NAVAL AVIONICS CENTER, INDIANAPOLIS, IND.
Deleterious effect of MIL-F-14256, type RA fluxes on printed wiring boards
[AD-A066129] N79-24274

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Coefficients of friction between calcareous sands and some building materials, and their significance
[AD-A066297] N79-24198
Corrosion and biofouling of OTEC system surfaces; Design factors
[AD-A066115] N79-24474
Digest of equipment for converting solar, wind, and geothermal energy into electric power for USN application ashore
[AD-A066221] N79-24475

NAVAL ELECTRONIC SYSTEMS COMMAND, WASHINGTON, D. C.
A review of the US Navy's Precise Time and Time Interval [PTTI] program
N79-24743

NAVAL OBSERVATORY, WASHINGTON, D. C.
Introduction to systems approach
N79-24732
Two-way time transfers between NRC/NBS and NRC/USNO via the Hermes [CTS] satellite
N79-24755

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Generation of non-homogeneous poisson processes by thinning: Programming considerations and comparison with competing algorithms
[AD-A066345] N79-24719

NAVAL RESEARCH LAB., ORLANDO, FLA.
ONR-NRL Superconducting Materials Symposium: A forecast
[AD-A066201] N79-24277

NAVAL RESEARCH LAB., WASHINGTON, D. C.
A review of recent results on spread F theory
[AD-A066175] N79-24233
Feasibility study of ferrite use at mm waves
[AD-A066178] N79-24235
Shielding of longitudinal magnetic fields with thin, closely, spaced concentric cylindrical shells with applications to atomic clocks
N79-24738
TEMPUS: A proposal for international time transfer and precision tracking satellite
N79-24760
Gallium-doped germanium, evaluation of photoconductors, part 1
[NASA-CR-152222] N79-24875

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS, MD.
The magnetic induction of the system consisting of a coil and a ferromagnetic spherical body
[AD-A065809] N79-24266
High impact shock evaluation of the diode assembly design used in a 3000-horsepower generator
[AD-A066143] N79-24276

NAVAL SURFACE WEAPONS CENTER, DAHLGREN, VA.
Clock performance as a critical parameter in navigation satellite systems
N79-24750

NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
Preparation of poly[dinitropropyl vinyl ether] with crosslinking sites, for use as a castable binder
[AD-A066079] N79-24164
SEATRACKS: A 35 GHz monopulse tracking radar
[AD-A065933] N79-24219
Permeability, magnetomechanical coupling and magnetostriction in grain-oriented rare earth-iron alloys
[IS-M-174] N79-24764

NAVY ASTRONAUTICS GROUP, POINT MUGU, CALIF.
Transit satellite system timing capabilities
N79-24751

NAVY EXPERIMENTAL DIVING UNIT, PANAMA CITY, FLA.
Test and evaluation of MAKO high-pressure breathing air compressor KA-51-DF
[AD-A065553] N79-24353

NEBRASKA UNIV. - LINCOLN.
A study of the Galerkin-Dorodnitsyn method applied to a three-dimensional, quasi-steady melting problem with a moving irradiation source
N79-24874

NEBRASKA UNIV., LINCOLN.
Electromagnetic fields in nonuniform multi-layered structures with engineering applications
[AD-A065515] N79-24228

NEC AMERICAN, INC., DALLAS, TEX.
Survey of timing/synchronization of operating wideband digital communications networks
N79-24747

NEW HAMPSHIRE UNIV., DURHAM.
Collisionless evolution of the auroral electron velocity distribution function
N79-24548
Convective electric field measurements in an auroral plasma
N79-24552

NEW MEXICO STATE UNIV., LAS CRUCES.
Recharge and ground water conditions in the western region of the Roswell basin
[PB-290577/6] N79-24426
Calculation of thermal emission from aerosols using the doubling technique
[AD-A065622] N79-24575

NEW MEXICO STATE UNIV., UNIVERSITY PARK.
Real-time video filtering with bit-slice microprogrammable processors
N79-24207
Experimental laser anemometry and analysis of electromagnetic waves in moving media
N79-24328

NEW MEXICO UNIV., ALBUQUERQUE.
Hydrodynamic lubrication with wear and asperity contact in mechanical face seals
[AD-A065924] N79-24357

NEW ORLEANS UNIV., LA.
Measurement of the thermal emission of tungsten and analysis of electron relaxation effects
N79-24866

NEW YORK UNIV., N. Y.
Atmospheric neutrons
[NASA-CR-3126] N79-24631
Diffusion limit for the transport of quasifree electrons in liquids
[AD-A065679] N79-24795

NORTH CAROLINA STATE UNIV., RALEIGH.
Investigation of aerodynamic characteristics of subsonic wings
[NASA-CR-158661] N79-23921

NORTH CAROLINA UNIV. AT CHAPEL HILL.
Weak convergence of progressively censored likelihood ratio processes
N79-24712
Projections and measures
N79-24725

NORTH CAROLINA UNIV., CHAPEL HILL.
Public participation in 208 water quality planning: A case study of Triangle J Council of Governments, North Carolina
[PB-290587/5] N79-24891

NORTH TEXAS STATE UNIV., DENTON.
Eckart frame motions and molecular vibrations
N79-24789
Fluid spheres in general relativity: Exact solutions and applications to astrophysics
N79-24886

NORTHEASTERN UNIV., BOSTON, MASS.
Analytical study of the time dependent spacecraft-plasma interaction
N79-24017
Electronics for a rocket borne quadrupole cluster ion mass filter
[AD-A066289] N79-24587

NORTHROP RESEARCH AND TECHNOLOGY CENTER, PALOS VERDES PENINSULA, CALIF.
Theoretical modeling of molecular and electron kinetic processes. Volume 1: Theoretical formulation of analysis and description of computer program
[AD-A066155] N79-24337
Theoretical modeling of molecular and electron kinetic processes. Volume 2: FORTRAN computer program listings, generalized laser kinetics synthesis and analysis, Boltzmann electron kinetics analysis
[AD-A066156] N79-24338

NORTHROP SERVICES, INC., RESEARCH TRIANGLE PARK, N. C.
Visible emissions evaluation, air pollution training course 439: Instructor manual
[PB-291860/5] N79-24526
Visible emissions evaluation, air pollution training course 439: Student manual
[PB-291861/3] N79-24527

NORTHWESTERN UNIV., EVANSTON, ILL.
Relation of structure to fatigue properties in aluminum-base alloys
[AD-A062698] N79-24127
Basic research on ceramic materials for energy storage and conversion system
[COO-2564-4] N79-24506

NOTRE DAME UNIV., IND.
Activity and selectivity of platinum single crystal surfaces and supported platinum catalysts for hydrocarbon reactions at atmospheric pressure
N79-24086

O

OAK RIDGE NATIONAL LAB., TENN.
Low Btu coal gasification processes. Volume 1: Summary, screening, and comparisons
[ORNL/ENG/TM-13-VOL-1] N79-24188
Econometric-engineering analysis of Federal energy conservation programs in the commercial sector
[ORNL/CON-30] N79-24489
Emergence of biotechnology
[TID-28983] N79-24626
ELMO Bumpy Torus
[ORNL/TM-6743] N79-24842
Influence of globalmagnetic perturbations on plasma behavior in Elmo Bumpy Torus
[ORNL/TM-6704] N79-24843

OFFICE OF SCIENCE AND TECHNOLOGY, WASHINGTON, D. C.
Earthquake hazards reduction: Issues for an implementation plan
[PB-290467/0] N79-24593

OHIO STATE UNIV., COLUMBUS.
Corrosion stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-5] N79-24132
Development and implementation of productivity measurement systems with emphasis on interorganization relationships
N79-24195
An analysis of the mutual coupling between antennas on a smooth convex surface
[AD-A065591] N79-24211
High frequency near field scattering by an elliptic disk
[AD-A065586] N79-24214
Fuselage-mounted antenna code: User's manual
[AD-A065587] N79-24215
Wing-mounted antenna code: User's manual
[AD-A065589] N79-24216
An iterative approach for computing an antenna aperture distribution from given radiation pattern data
[AD-A065590] N79-24217
Optimum frequencies for aircraft classification
[AD-A065697] N79-24220
An asymptotic result for the scattering of a plane wave by a smooth convex cylinder
[AD-A065588] N79-24229
The operational approach to physical geodesy
[AD-A063887] N79-24422
An investigation of the pulse-scatter imaging technique for medical ultrasonic imaging and tissue characterization
N79-24628

OHIO UNIV., ATHENS.
Design of signal synthesis model reference adaptive control systems for linear and nonlinear unknown plants
N79-24680
Neutron scattering on even isotopes of tin
N79-24870

OKLAHOMA STATE UNIV., STILLWATER.
Phase equilibrium and volumetric properties of coal-derived fluids
[FE-2278-9] N79-24179
Multistep energy migration and radiationless relaxation processes in phosphor and laser crystals
[AD-A066086] N79-24334
Role of inorganic carbon availability in the formation of nuisance blooms of blue-green algae
[PB-290716/0] N79-24542
OKLAHOMA UNIV., NORMAN.
Analysis of coke combustion during in-situ oil recovery
N79-24095
Fracture prediction in plane elasto-plastic problems by the finite element method
N79-24367
A two-dimensional numerical simulation of the dry line environment and its role in the development of mesoscale convective systems
N79-24553
Error analysis of digital filters with logarithmic number system
N79-24660
OLD DOMINION UNIV., NORFOLK, VA.
Numerical optimization techniques for bound circulation distribution for minimum induced drag of non-planar wings: Basic formulations
[NASA-CR-3154] N79-23924
High-temperature microphone system
[NASA-CASE-LAR-12375-1] N79-24203
OPTICAL COATING LAB., INC., CITY OF INDUSTRY, CALIF.
Development of high efficiency [14%] solar cell array module
[NASA-CR-158672] N79-24454
OREGON STATE UNIV., CORVALLIS.
Geographical information systems: A review
[PB-290748/3] N79-24424
OREGON UNIV., EUGENE.
Some uniqueness problems in nonlinear L sub p-approximation
N79-24693
ORINCON CORP., LA JOLLA, CALIF.
New fidelity criteria for discrete-time source encoding
[AD-A065802] N79-24218
OXFORD UNIV. [ENGLAND].
Measurement of the drag of slender cones in hypersonic flow at low Reynolds numbers using a magnetic suspension and balance
[OUEL-1235/78] N79-23938
Multi-fluid, high temperature cavitation tunnel: Description and operating manual
[OUEL-1196/77] N79-24311
Viscous effects on cavitation inception on a two dimensional cylinder
[OUEL-1225/78] N79-24312
Identification of flow type using heated thin films
[OUEL-1238/78] N79-24313
Vapour flows and heat conductances in ventilated cavities behind a two-dimensional cylinder. Part 1: Review of entrainment and thermodynamic effect; viscous effects on limited and developed cavitation
[OUEL-1245/78] N79-24314
Feasibility study of the application of self-tuning controllers to chemical batch reactors
[OUEL-1248/78] N79-24326
A variational solution of the frictional unloading problem
[OUEL-1212/77] N79-24396
The Boussinesq and Cerruti solutions for a transversly isotropic half-space
[OUEL-1232/78] N79-24397
Optimum plastic design of a variable-thickness orthotropic plate under in-plane loading
[OUEL-1237/78] N79-24398
Generalised displacement functions
[OUEL-1244/78] N79-24399
An analytical approach to wind velocity gust factors
[OUEL-1241/78] N79-24620
Simulation study of self-tuning control laws
[OUEL-1201/77] N79-24683
Non-linear model fitting and function minimisation package
[OUEL-1194/77] N79-24706
A convergence proof for constrained finite element solutions
[OUEL-1223/77] N79-24707
A Nyquist type criterion for input/output stability of linear time-invariant systems
[OUEL-1240/78] N79-24724
The scanning optical microscope
[OUEL-1243/78] N79-24829
On the mathematical formulation of the first principle of thermodynamics for non-uniform temperature processes
[OUEL-1251/78] N79-24887
Minimum variance control, estimation and simulation of nonlinear models of wastewater treatment systems
[OUEL-1214/77] N79-24902

P

PACIFIC-SIERRA RESEARCH CORP., SANTA MONICA, CALIF.
An integral-equation approach to ELF propagation in a non-stratified earth-ionosphere waveguide
[AD-A066097] N79-24230
PARIS-SUD UNIV., ORSAY [FRANCE].
Nitrogen excitation by metastable argon atoms
[LP-170] N79-24850
PARKER [LEE W.], INC., CONCORD, MASS.
Plasma sheath effects and voltage distributions of large high-power satellite solar arrays
N79-24024
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Potential mapping with charged-particle beams
N79-24038
Stable dielectric charge distributions from field enhancement of secondary mission
N79-24046
The reaction of phenyllithium with poly-[dichlorophosphazene]
[AD-A066183] N79-24165
Development of measurement techniques for monitoring chemical purity of materials used in digital IC processing
[PB-291427/3] N79-24199
Large deflection response of elastic/visco-plastic beams under combined tension and bending
N79-24366
Evaluation of flow properties of dilute aqueous polymer solutions for enhanced oil recovery applications
N79-24408
PENNSYLVANIA UNIV., PHILADELPHIA.
Cytochemical study related to laser application
[AD-A065671] N79-24335
The power of sequential model selection procedures
N79-24715
A theory of anharmonic effects in vibrational nuclei
N79-24809
PLANNING RESEARCH CENTER, MCLEAN, VA.
Application and system design study for cost-effective solar photovoltaic systems at Federal installations
[HCP/CS-0306] N79-24500
POLYTECHNIC INST. OF NEW YORK, BROOKLYN.
Application of foam separation to aqueous solutions of trinitrotoluene [TNT]. Part 2: Removal of organic explosives with surfactants
[AD-A066118] N79-24103
PRATT AND WHITNEY AIRCRAFT GROUP, WEST PALM BEACH, FLA.
Engine rotor dynamics, synchronous and nonsynchronous whirl control
[AD-A066093] N79-23975
PRINCETON UNIV., N. J.
A comparison of the aerodynamic characteristics of eight sailwing airfoil sections
N79-23897
Engineering implications following the attachment of catalytically active transition metal complexes onto solid supports the leaky catalyst
N79-24080
Polymerization of sicica in aqueous solutions
N79-24149
Solid propellant combustion mechanism research
[AD-A065761] N79-24173
The atmospheric circulation around Antarctica: Linear stability and finite amplitude interactions with the mid-latitudes of the Southern Hemisphere
N79-24547
Data compression: Methods and complexity issues
N79-24662
Representing simple polytopes by order structures
N79-24688
Radioactive waste disposal: A comparison of alternative nuclear fuel cycles
N79-24812
PROTOTYPE DEVELOPMENT ASSOCIATES, INC., SANTA ANA, CALIF.
Hardened RV development program. Phase 4: Vehicle recovery technology wind tunnel tests
[AD-A066095] N79-23930
Flame nosetip recovery vehicle flight test series
[AD-A066217] N79-24058
Application of Nitinol to high stiffness structural joints
[AD-A065561] N79-24377
PURDUE UNIV., LAFAYETTE, IND.
Effect of high load on the fatigue behavior of unnotched graphite/epoxy laminates
[AD-A065631] N79-24069
Systems studies of coal conversion processes using a reference simulator
[FE-2275-8] N79-24187
Stratification and sample selection for multicrop experiments
[E79-10190] N79-24410
Research in remote sensing of agriculture, earth resources, and man's environment
[E79-10195] N79-24415
Urban water resources policy alternatives: A sociological analysis of differential perspectives
[PB-290583/4] N79-24538
Disturbed versus undisturbed conditions in the Caribbean during the intensification of Hurricane Carmen [1974]
[AD-A065517] N79-24612

Q

QUEENS UNIV., BELFAST [NORTHERN IRELAND].
Flexural vibrations of annular plates under uniform inplane compressive forces
N79-24375

R

RADIAN CORP., AUSTIN, TEX.
Ozone/ultraviolet radiation monitoring
[PB-290594/1] N79-24539
A study of ozone concentrations in Southern Louisiana
[PB-291823/3] N79-24598
RANGE COMMANDERS COUNCIL, WHITE SANDS MISSILE RANGE, N. MEX.
Atmospheric refraction measurements and related efforts
[AD-A065766] N79-24574
RCA FLIGHT OPERATIONS, TRENTON, N. J.
Civil Helicopter icing problems
N79-23917
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Wing shape optimization for maximum cross-country speed, with mathematical programming
N79-23899
Signal processing with saw devices
[AD-A065520] N79-24223
Analysis of acoustical effects of receiver and source motions at short ranges in the deep ocean
[AD-A066199] N79-24776
Contactless measurement of carrier generation rate in semiconductors
[AD-A062880] N79-24876
RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
An analysis of air pollution and its health effects: Washington, D.C. metropolitan area
[PB-290618/8] N79-24545
RICE UNIV., HOUSTON, TEX.
Space environmental effects and the solar power satellite
N79-24028
Research in fluorine chemistry
[AD-A065527] N79-24099
ROCHESTER UNIV., N. Y.
Studies of photographic grain in a coherent optical system: Signal-dependence and its implications
[AD-A062528] N79-24325
A Gaussian approximation to the distribution of sample variance for nonnormal populations
[AD-A065738] N79-24699
ROCKWELL INTERNATIONAL CORP., ANAHEIM, CALIF.
Rubidium frequency standard test program for NAVSTAR GPS
N79-24745
ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Inorganic halogen oxidizer research
[AD-A066149] N79-24177
ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
Secondary electron effects on spacecraft charging
N79-24048
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
Barnacle electrode measurement system for hydrogen in aircraft steel
[AD-A065945] N79-24126
ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Electric fields in irradiated dielectrics
N79-24035
RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
Polynomial representations and an iterative procedure for filter realization
N79-24255
Methodologies of examining pollution from urban runoff
[PB-290595/8] N79-24427
Dual purpose detention basins and surveillance procedures in urbanizing watersheds
[PB-290989/3] N79-24428
Bifurcation of periodic solutions in functional differential equations
N79-24684
Existence and uniqueness of positive solutions of a nonlinear integral solutions of a nonlinear integral solution
N79-24685
Interval counts and threshold numbers of graphs
N79-24689

Hypothesis testing for the common mean of two normal distributions with unknown variances when the null and alternative hypotheses are separated by a zone of indifference
N79-24713
Piecewise polynomials for the probability of clustering on the unit interval
N79-24714
Coupling of electronic and vibrational motions in molecules
N79-24790
Thermal conductivity of granular aluminum
N79-24852
An investigation of effects associated with thermal counterflow in rotating superfluid helium
N79-24869

S

SAH [C. T.] ASSOCIATES, URBANA, ILL.
Study of the effects of impurities on the properties of silicon materials and performance of silicon solar cell
[NASA-CR-158678] N79-24447
SANDIA LABS., ALBUQUERQUE, N. MEX.
Research at Sandia Laboratories for Solar Thermal Large Power Systems Program
[SAND-78-8051] N79-24510
Photovoltaic concentrator system technology and applications experiments
[SAND-78-2184] N79-24511
Hydrogen depth profiling using elastic recoil detection
[SAND-79-0210C] N79-24878
SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Exhaust gas composition of the F-16 emergency power unit
[AD-A065595] N79-24102
SCIENCE APPLICATIONS, INC., ANN ARBOR, MICH.
Tuned diode laser measurements of atmospheric absorption profiles in the 4.5 micrometers to 5.0 micrometers region
[AD-A066159] N79-24584
SCIENCE APPLICATIONS, INC., LA JOLLA, CALIF.
Electron transport model of dielectric charging
N79-24018
Spacecraft charging standard
N79-24050
Spacecraft charging modeling development and validation study
N79-24051
SCIENCE APPLICATIONS, INC., MCLEAN, VA.
Tropical cyclone strike probability forecasting
[AD-A065545] N79-24611
SCIENCE APPLICATIONS, INC., SCHAUMBURG, ILL.
Mercury orbiter transport study
[NASA-CR-158658] N79-23987
Advanced planetary studies
[NASA-CR-158657] N79-24915
Multiple Discipline science assessment
[NASA-CR-158656] N79-24916
SCOTT POLAR RESEARCH INST., CAMBRIDGE [ENGLAND].
An analysis of ice profiles obtained by submarine sonar in the AIDJEX area of the Beaufort Sea
[AD-A066336] N79-24586
SHAKER RESEARCH CORP., BALLSTON LAKE, N. Y.
Rotor-bearing dynamics technology design guide. Part 2: Ball bearings
[AD-A065554] N79-24355
Development of sensitized pick coal interface detector system
[NASA-CR-161225] N79-24417
SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Method of calculating retroreflector-array transfer functions
[NASA-CR-157932] N79-24821
SOARING SOCIETY OF AMERICA, LOS ANGELES, CALIF.
How accurate is NETTO
N79-23901
SOLAREX CORP., ROCKVILLE, MD.
Analysis of the effects of impurities in silicon
[NASA-CR-157439] N79-24456
SOLCOST SERVICE CENTER, FORT COLLINS, COLO.
SOLCOST: Space heating handbook with service hot water and heat loads calculations
[DOE/CS-0042/3] N79-24501
SOUTH CAROLINA UNIV., COLUMBIA.
Feasibility of remote sensing benthic microalgae
[NASA-CR-158618] N79-24418
Adaptive observers and controllers with an arbitrarily fast exponential rate of convergence
N79-24722
The measurement of absolute pair production cross-sections at near-threshold energies and the development of a high resolution position spectrometer
N79-24783
Optimization and application of microwave-excited discharges
N79-24830
SOUTHERN METHODIST UNIV., DALLAS, TEX.
Direct sequence spread spectrum signalling
N79-24205
Subsurface temperatures from surface heat flow data using equivalent plane sources
N79-24561
Mathematical programming methods for urban transportation networks
N79-24897
SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
Sampling charged particles with cascade impactors
[PB-290897/8] N79-24540
SPACE AND MISSILE SYSTEMS ORGANIZATION, LOS ANGELES AIR FORCE STATION, CALIF.
Description of the Space Test Program P78-2 spacecraft and payloads
N79-24002
SPACE AND MISSILE TEST CENTER, VANDENBURG AFB, CALIF.
Precise terrestrial time: A means for improved ballistic missile guidance analysis
N79-24736
SPECTRON DEVELOPMENT LABS., INC., COSTA MESA, CALIF.
Examination of automatic data reduction methods for particle field holograms
[PB-290909/1] N79-24544
SPIRE CORP., BEDFORD, MASS.
A combined spacecraft charging and pulsed X-ray simulation facility
N79-24054
Development of pulsed processes for the manufacture of solar cells
[NASA-CR-158676] N79-24450
Integral glass encapsulation for solar arrays
[DOE/JPL-954521-79/9] N79-24452
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Characterization of electromagnetic signals generated by electrical breakdown of spacecraft insulating materials
N79-24055
Development of the Transient Pulse Monitor [TPM] for Scatha/P78-2
N79-24056
Further development of the multipactor discharge electron source
N79-24057
A study to determine the mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater
[AD-A066257] N79-24130
Production of cracks in ZnS under a uniform dynamic stress field
[AD-A065941] N79-24159
Comparative equatorial scintillation morphology: American and pacific sectors
[AD-A066094] N79-24224
Nap-of-the-earth communication program for US Army helicopters
[AD-A063089] N79-24232
STANFORD UNIV., CALIF.
Fibrous refractory composite insulation
[NASA-CASE-ARC-11169-1] N79-24062
JSEP achievements 1961-1978 [update of 15-year report dated September 1976]
[AD-A065670] N79-24271
Basic studies of high performance multialkali photocathodes
[AD-A066064] N79-24273
HCMM: Soil moisture in relation to geologic structure and lithology, northern California
[E79-10192] N79-24412
STATE UNIV. OF NEW YORK AT ALBANY.
Ion-molecule interactions of atmospheric importance
N79-24551
STATE UNIV. OF NEW YORK AT BUFFALO.
Extrapolation and spectral estimation techniques for discrete time signals
[AD-A066139] N79-24236
STATE UNIV. OF NEW YORK AT STONY BROOK.
Life games: Statistical, deterministic and computer approaches in physics
N79-24721
Influence of thermal disorder on electronic properties of solids
N79-24872
STOCKHOLM UNIV. [SWEDEN].
Some examples of total aerosol weight accounted for by major inorganic soluble compounds
[AC-46] N79-24525
A mixed layer model of wind and density driven mixing during a phytoplankton bloom
[DM-24] N79-24619
STUTTGART UNIV. [WEST GERMANY].
The effect of disturbance on a wing
N79-23893
Some new airfoils
N79-23896
Higher order methods for transient diffusion analysis
[ISD-222] N79-24308
Loaded shells with rigid mantels
[ISD-227] N79-24385
Incremental formulation in nonlinear mechanics and large strain analysis of elasto-plastic and elasto-viscoplastic problems. Natural finite element approach
[ISD-232] N79-24386
Thermomechanical calculations for massive structures using a finite element method
[ISD-234] N79-24387
A class of structural optimization problems: Optimal archgrids
[ISD-236] N79-24388
Optimal beam layouts: Allowance for cost of shear
[ISD-237] N79-24389
Inelastic resistance calculations with time dependent thermal and mechanical stress
[ISD-238] N79-24390
Geometrically nonlinear finite element behavior using buckling mode superposition
[ISD-241] N79-24391
On large displacement-small strain analysis of structures with rotational degrees of freedom
[ISD-247] N79-24392
Note on large strain applications of a modified constant strain finite element method
[ISD-248] N79-24393
On the natural factor in nonlinear analysis
[ISD-242] N79-24702
SWEDISH COUNCIL FOR BUILDING RESEARCH, STOCKHOLM.
Swedish solar energy projects, 1978
[SIB-D-13-1978] N79-24502
SYDNEY UNIV. [AUSTRALIA].
Some experimental observations of the flow through gauze screens
[ATN-7804] N79-24300
The flow through a gauze screen
[ATN-7801] N79-24301
SYSTEMS APPLICATIONS, INC., SAN RAFAEL, CALIF.
Modeling of simulated photochemical smog with kinetic mechanisms, Volume 1
[PB-290507/3] N79-24531
Modelling of simulated photochemical smog with kinetic mechanisms. Volume 2: Appendix
[PB-290508/1] N79-24532
SYSTEMS SCIENCE AND SOFTWARE, LA JOLLA, CALIF.
The capabilities of the NASA charging analyzer program
N79-24011
Charging analysis of the SCATHA satellite
N79-24012

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
On the Optimization of a stiffened square panel under buckling constraints
[DAS-M-6] N79-24376
TECHNION, INC., IRVINE, CALIF.
Mechanisms of magnetoplasmadynamic arcjet acceleration processes
[AD-A065617] N79-24060
TECHNISCHE HOCHSCHULE, DARMSTADT [WEST GERMANY].
Optimum tail plane design for sailplanes
N79-23892
TECHNISCHE UNIV., BERLIN [WEST GERMANY].
Generation and breakdown of aerodynamic lift: Physical mechanism
N79-23894
TEMPLE UNIV., PHILADELPHIA, PA.
Waiting times and return periods related to order statistics
N79-24708
Partially balanced residual effects designs
N79-24709
Consequences of the renormalization group for the thermodynamics of fluids near the critical point
N79-24884
TENNESSEE UNIV., KNOXVILLE.
An experimental study of transonic turbulent flow separation
N79-23907
Analysis of a fractional gas stripper
N79-24084
Nuclear magnetic studies of triethylborane with cobalt and nickel compounds
N79-24116
The high temperature aqueous modification of polybutadiene and a styrene crosslinked unsaturated polyester
N79-24145
Analyzing the solution of problems involving three-dimensional geometric figures: An exploratory study
N79-24687
TEXAS A&M UNIV., COLLEGE STATION.
Pressure-volume-temperature relations of ethane, of methyl chloride and of the equimolar mixture using the Burnett-isochoric method
N79-24087

Pathways for intramolecular carbonyl exchange in some metal carbonyl complexes
N79-24115
Optimization of the second order logarithmic machine economics problems by extended geometric programming
N79-24194
Multiple antenna beam formation techniques for synthetic aperture radar
N79-24206
Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis
N79-24407
Physical properties of sediments from the continental margin of western Africa
N79-24555
Study of low energy charge transfer collisions using a radio frequency quadrupole ion trap
N79-24784

TEXAS CHRISTIAN UNIV., FORT WORTH.
A statistical rationale for relating situational attributes and individual differences
[AD-A066088] N79-24718

TEXAS INSTRUMENTS, INC., DALLAS.
LSA silicon material task closed-cycle process development
[NASA-CR-158677] N79-24449
LSA Large area Silicon sheet task continuous Czochralski process development
[NASA-CR-158675] N79-24451

TEXAS UNIV. AT AUSTIN.
Effect of annealing below the glass transition temperature on sorption and transport of carbon dioxide in polycarbonate
N79-24148
A study of miscibility in blends of polycarbonate with polyesters
N79-24150
Flexural behavior of reinforced sulfur-infiltrated concrete beams
N79-24196
Existence and approximations for saddle-point problems with application to nonlinear incompressible elasticity
N79-24365
Automatic history matching of geopressured-geothermal reservoir performance data by use of optimal control theory
N79-24409
Types of karst, with emphasis on cover beds in their classification and development
N79-24556
Marine magnetic anomalies from the western and northern Philippine Sea: Implications for the evolution of marginal basins
N79-24560
Parallel algorithms for multiple processor architectures
N79-24663
A system for incrementally designing and verifying programs
N79-24669
Algorithmic and computer code developments for combinatorial and network problems
N79-24679
Proton and pion elastic scattering from nuclei as a probe of nucleon-nucleon correlations
N79-24810
Numerical simulation of spherically symmetric matter in relativity
N79-24883
Stochastic analysis of a high-rate activated sludge wastewater treatment plant with random diurnal plant inputs and random process parameters, via Monte-Carlo simulation
N79-24896
A magnetic study of the spotted UV Ceti flare stars and related late-type dwarfs
N79-24918
A photometric and kinematic study of the barred spiral galaxy NGC 253
N79-24923
A study of molecular clouds near supernova remnants
N79-24924
Orbital theories of outer planet satellites
[NASA-CR-158667] N79-24925
Lunar laser ranging data identification and management
[NASA-CR-158649] N79-24930
Lunar laser ranging data deposited in the National Space Science Data Center normal points, filtered observations, and unfiltered photon detections
[NASA-CR-158648] N79-24931

TEXAS UNIV. AT DALLAS, RICHARDSON.
Multiphoton spectroscopy of Cs-inert gas
N79-24781
Relaxation of excited neon atoms in their parent gas
N79-24786

TEXAS UNIV. AT GALVESTON.
The effects of high nitrogen tensions of the properties of neuronal membranes and synaptic transmission
[AD-A063856] N79-24647

TEXTRON BELL AEROSPACE CO., BUFFALO, N. Y.
Numerical model development for laser cavity flowfields
[AD-A065836] N79-24336

TORONTO UNIV. [ONTARIO].
Scaling laws and edge effects for polymer surface discharges
N79-24041

TRACOR JITCO, INC., ROCKVILLE, MD.
Chemicals identified in human biological media, a pilot literature survey
[PB-290690/7] N79-24649

TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
Service methods demonstration program
[PB-292008/0] N79-24898

TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Thermal blanket metallic film groundstrap and second surface mirror vulnerability to arc discharges
N79-24042
Secondary emission effects on spacecraft charging: Energy distribution considerations
N79-24047
TDRSS solar array arc discharge tests
N79-24053

TRW, INC., DURHAM, N. C.
Demonstration of Wellman-Lord/Allied Chemical FGD technology: Acceptance test results
[PB-290514/9] N79-24534

TULSA UNIV., OKLA.
Experimental study of the kinetics of dry, forward combustion
[BETC-1820-1] N79-24106

U

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, ABINGDON [ENGLAND].
Variational approach to nonlinear self-focusing of Gaussian laser beams
[CTH-IEFT/PP-1977-11] N79-24339
Interpretation of enhanced laser-plasma backscattering due to prepulse radiation
N79-24340

UNITED RESEARCH SERVICES, SAN MATEO, CALIF.
Protection, cleanup and restoration of salt marshes endangered by oil spills: A procedural manual
[PB-291958/7] N79-24522

UNITED TECHNOLOGIES CORP., SUNNYVALE, CALIF.
Rotating valve for velocity coupled combustion response measurements
[AD-A065741] N79-24174

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Excimer potential curves
[AD-A066043] N79-24332

UTAH UNIV., SALT LAKE CITY.
Steam reforming of aromatic compounds
N79-24093
Hydropyrolysis of coal derived liquids and related model compounds
N79-24171
A primitive equation spectral model for the study of stratospheric sudden warmings
N79-24546

V

VANDERBILT UNIV., NASHVILLE, TENN.
Studies in the theory and practices of foam flotation techniques
N79-24077
Agitated batch and packed column activated carbon adsorption
N79-24090
Charged multiplicity distributions and neutral strange particle production in antiproton-deuteron and negative pion-deuteron interactions at 100 GeV/c
N79-24807

VARIAN ASSOCIATES, BEVERLY, MASS.
CFA design improvement program. Volume 1: Instrumented CFA studies
[AD-A065735] N79-24262
CFA design improvement program. Volume 2: Computer modeling studies
[AD-A065736] N79-24263

VARIAN ASSOCIATES, PALO ALTO, CALIF.
The III - V heterostructure avalanche photodiode modules for fiber optic communication links in the 1.0 to 1.3 micrometer spectral range
[AD-A065537] N79-24272
High power millimeter wave amplifier
[AD-A062966] N79-24275
Research on lattice-mismatched semi-conductor layers
[SAN-1250-4] N79-24880

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
An evaluation of stiffness reduction as a damage parameter and criterion for fatigue failure in composite materials
N79-24063
Investigation and characterization of constraint effects on flaw growth during fatigue loading of composite materials
[NASA-CR-158659] N79-24067
A dynamic multi-criteria analysis of spent-nuclear-fuel alternatives
N79-24813

VIRGINIA UNIV., CHARLOTTESVILLE.
Evaluating and minimizing noise impact due to aircraft flyover
[NASA-CR-158619] N79-24769

VOUGHT ASTRONAUTICS, DALLAS, TEX.
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recovery from small ships. Volume 1: Program description
[AD-A066172] N79-23954
VOLAR: A digital computer program for simulating VSTOL aircraft launch and recover from small ships. Volume 2: Appendices
[AD-A066173] N79-23955

VOUGHT CORP., DALLAS, TEX.
Development of a prototype flexible radiator system
[NASA-CR-160166] N79-24299

VOUGHT CORP., HAMPTON, VA.
Minimization theory of induced drag subject to constraint conditions
[NASA-CR-3140] N79-23923

VOUGHT HELICOPTER, INC., DALLAS, TEX.
Structural properties of adhesives, volume 1
[AD-A065500] N79-24155
Structural properties of adhesives. Volume 2: Appendices. A: The symmetric lap shear test. B: Adhesive joint fabrication and test specifications
[AD-A065521] N79-24156

W

WASHINGTON UNIV., SEATTLE.
Middle atmosphere project. A semi-spectral numerical model for the large-scale stratospheric circulation
[NASA-CR-158653] N79-24567
Digital system theory
[AD-A065764] N79-24681

WASHINGTON UNIV., ST. LOUIS, MO.
GaAs waveguide detector array for an IOC spectrum analyzer
[AD-A065824] N79-24265
GaAs electroabsorption avalanche photodiode waveguide detectors
[AD-A065986] N79-24824

WAYNE STATE UNIV., DETROIT, MICH.
Mass transfer and kinetic studies on rotating electrodes
N79-24091
Cuprous oxide photovoltaic cells
[PB-290529/7] N79-24514
Studies on the microwave-induced auditory effect
[PB-290598/2] N79-24648

WEST VIRGINIA UNIV., MORGANTOWN.
Mechanisms of particle transport and electro-kinetic phenomena in a cross flow/electrofilter
N79-24088
The effect of carbon monoxide and methane on the resistance of tin oxide thin films
N79-24256
Heat transfer simulation in underground coal liquefaction
N79-24292
Stress and fatigue in the driving environment
N79-24629
A recycled-water sanitary waste disposal system
[PB-291740/9] N79-24914

WESTINGHOUSE DEFENSE AND ELECTRONIC SYSTEMS CENTER, BALTIMORE, MD.
Broadband zinc oxide transducer for integrated optics
[AD-A062851] N79-24827

WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, PITTSBURGH, PA.
The array automated assembly task for the low cost solar array project, phase 2
[NASA-CR-158538] N79-24469
Effects of impurities and processing on silicon solar cells, phase 3
[NASA-CR-158569] N79-24472

WITWATERSRAND UNIV., JOHANNESBURG [SOUTH AFRICA].
A depth-duration-frequency diagram for point rainfall in southern Africa
[REPT-2-78] N79-24608

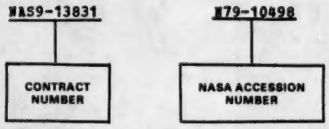
WYLE LABS., INC., HUNTSVILLE, ALA.
Evaluation of SHABERTH: A bearing simulation computer program
[NASA-CR-161205] N79-24349

Y

YORK UNIV., DOWNSVIEW [ONTARIO].
Prediction of ion drift effects on spacecraft floating potentials
N79-24015

Numerical calculations of high-altitude differential charging: Preliminary results
N79-24016

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 4860
N79-24163

AF PROJ. 1123
N79-23985

AF PROJ. 2001
N79-24827

AF PROJ. 2003
N79-23958

AF PROJ. 2301
N79-24798

AF PROJ. 2303
N79-24169

AF PROJ. 2304
N79-24220
N79-24336
N79-24681
N79-24726

AF PROJ. 2306
N79-24761
N79-24876

AF PROJ. 2307
N79-23926
N79-24304

AF PROJ. 2308
N79-24059
N79-24060
N79-24174

AF PROJ. 2338
N79-24268

AF PROJ. 2403
N79-23947

AF PROJ. 2418
N79-24124

AF PROJ. 2419
N79-24167
N79-24168

AF PROJ. 3048
N79-24356

AF PROJ. 3066
N79-23974

AF PROJ. 4643
N79-24577

AF PROJ. 6096
N79-24666

AF PROJ. 6114
N79-24673

AF PROJ. 6244
N79-24825

AF PROJ. 6670
N79-24581
N79-24613

AF PROJ. 7601
N79-24668

AF PROJ. 8809
N79-24267

AF-AFOSR-2116-71
N79-24700

AF-AFOSR-2570-73
N79-24701

AF-AFOSR-2583-74
N79-24761

AF-AFOSR-2611-74
N79-24220

AF-AFOSR-2645-74
N79-24331

AF-AFOSR-2672-74
N79-24059

AF-AFOSR-2730-74
N79-24303

AF-AFOSR-2851-75
N79-23942

AF-AFOSR-2892-76
N79-24127

AF-AFOSR-2962-76
N79-24015
N79-24016

AF-AFOSR-2971-76
N79-24123

AF-AFOSR-3092-76
N79-24726

AF-AFOSR-3172-77
N79-24304

AF-AFOSR-3330-77
N79-24376

AF-AFOSR-3360-77
N79-24699

AF-AFOSR-3426-77
N79-24876

AF-AFOSR-3546-78
N79-24681

AF-AFOSR-3731-78
N79-24017

ARPA ORDER 512
N79-24578

ARPA ORDER 600
N79-24238

ARPA ORDER 2397
N79-24199
N79-24267

ARPA ORDER 2840
N79-24332

ARPA ORDER 3045
N79-24225
N79-24237

ARPA ORDER 3192
N79-24275

ARPA ORDER 3194
N79-24667

AT(49-24)-0293
N79-24382
N79-24405

B-BH-71746 N79-24314

DA PROJ. 1F2-62209-AH-76
N79-23975

DA PROJ. 1L1-61101-A-91A
N79-24305

DA PROJ. 1L1-61102-AH-43
N79-24175

DA PROJ. 1L1-61102-B-53A
N79-24575

DA PROJ. 1L2-62209-AH-76
N79-23973

DA PROJ. 1L6-62618-AH-80
N79-24070

DA PROJ. 1L7-62705-AH-94
N79-24270

DA PROJ. 1T1-61101-A-91A
N79-24324

DA PROJ. 3A1-61102-B-71P
N79-24335

DA PROJ. 3E7-62772-A-813
N79-24335

DA PROJ. 8X3-63304-D-215
N79-24763

DA-ARO(D)-31-124-71-G125
N79-24099

DAAA09-75-C-2056
N79-24128

DAAA09-76-C-2013
N79-23949

DAAA21-76-C-0104
N79-24103

DAAB07-75-C-0044
N79-24774

DAAB07-76-C-0868
N79-24232

DAAB07-77-C-0526
N79-24270

DAAB07-78-C-2402
N79-24272

DAAG29-75-C-0003
N79-24273

DAAG29-76-C-0050
N79-24584

DAAG29-76-G-0099
N79-24334

DAAG29-77-G-0014
N79-24325

DAAG29-77-G-0187
N79-24099

DAAG29-77-G-0205
N79-24223

DAAG29-78-A-0206
N79-24236

DAAJ02-76-C-0011
N79-23975

DAAJ02-77-C-0006
N79-23973

DAAJ02-77-C-0020
N79-23931
N79-23932
N79-23933
N79-23934

DAAK11-77-C-0023
N79-23949
N79-23950
N79-24378

DAAK40-77-C-0156
N79-24222

DAAK40-78-C-0037
N79-24823

DABA18-77-C-0003
N79-24575

DABC04-74-G-0187
N79-24099

DABC04-75-G-0076
N79-24228

DABD17-74-C-4143
N79-24335

DARPA ORDER 2062
N79-24333

DASG60-77-C-0056
N79-24333

DE-A101-79ET20485
N79-24443

DGRST-76-7-0067
N79-24881

DGRST-76-7-0779
N79-24108

DGRST-76-7-0788
N79-24822

DHEW-100-77-0014
N79-24520

DI-7-07-83-V0003
N79-24594

DI-14-16-0008-1199
N79-24425

DI-14-31-0001-4067
N79-24429

DI-14-31-0001-5201
N79-24515

DI-14-31-0001-5213
N79-24538

DI-14-34-0001-5128
N79-24427

DI-14-34-0001-6032
N79-24426

DI-14-34-0001-6523
N79-24110

DI-14-34-0001-7104
N79-24914

DI-14-34-0001-7112
N79-24903
N79-24904

DI-14-34-0001-7124
N79-24427

DI-14-34-0001-7545
N79-24110

DI-14-34-0001-8035
N79-24891

DI-14-34-0001-8038
N79-24542

DI-14-34-0001-9032
N79-24428

DNA001-74-C-0295
N79-24058

DNA001-76-C-0310
N79-23930

DNA001-77-C-0009
N79-24037

DNA001-77-C-0096
N79-24227

DNA001-77-C-0220
N79-24224

DOT-CG-42357-A
N79-24104

E(49-18)-2099
N79-24701

E(49-28)-1002
N79-24442
N79-24445

EC-77-A-31-1062
N79-24444

EC-77-C-01-4063
N79-24477

EF-77-A-01-2565
N79-24183

EF-77-A-01-2674
N79-24446

EG-77-C-01-255
N79-24498

EG-77-C-01-2522
N79-24481
N79-24485
N79-24486
N79-24496
N79-24499
N79-24500

EG-77-C-01-4042
N79-24180

EG-77-C-01-4049
N79-24480
N79-24481
N79-24482
N79-24483
N79-24484
N79-24485
N79-24486
N79-24495
N79-24496
N79-24497
N79-24498
N79-24499

EH-78-C-01-4250
N79-24493

EH-77-S-02-0294
N79-24800

EPA-GS-05S-10458
N79-24327

EPA-R-803585 N79-24908

EPA-R-804829 N79-24543

EPA-68-01-2934
N79-24535

EPA-68-01-3993
N79-24906

EPA-68-01-4116
N79-24649

EPA-68-01-4350
N79-24111

EPA-68-01-4839
N79-24912

EPA-68-02-0048
N79-24526

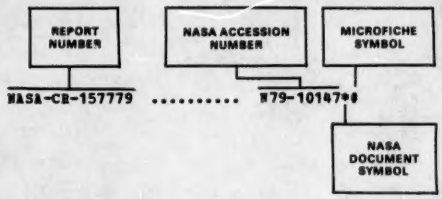
EPA-68-02-1785
N79-24533

EPA-68-02-1877 N79-24534
EPA-68-02-2131 N79-24540
EPA-68-02-2374 N79-24527
EPA-68-02-2428 N79-24531 N79-24532
EPA-68-02-2491 N79-24544
EPA-68-03-2160 N79-24522
EPA-68-03-2415 N79-24545
ET-77-C-01-8890 N79-24488
ET-77-S-03-1820 N79-24106
ET-78-01-3395 N79-24695
EX-76-A-29-1060 N79-24465
EX-76-C-01-2047 N79-24185
EX-76-C-01-2210 N79-24306
EX-76-C-01-2251 N79-24182
EX-76-C-01-2270 N79-24181
EX-76-C-01-2275 N79-24187
EX-76-C-01-2278 N79-24179
EX-76-C-01-2338 N79-24176
EX-76-C-01-2434 N79-24184
EX-76-C-01-2490 N79-24190
EX-76-C-01-2531 N79-24501
EX-76-S-01-2340 N79-24186
EX-76-C-02-0016 N79-24307 N79-24491 N79-24492 N79-24504 N79-24509 N79-24616 N79-24815
EX-76-C-02-3073 N79-24765
EX-76-C-03-0700 N79-24384
EX-76-C-03-1250 N79-24880
EX-76-C-04-0053 N79-24107 N79-24505
EX-76-C-04-0613 N79-24131 N79-24278 N79-24279 N79-24615
EX-76-C-04-0700 N79-24510
EX-76-C-04-0789 N79-24071 N79-24170 N79-24511 N79-24512 N79-24878
EX-76-C-06-1830 N79-24170 N79-24487
EX-76-C-09-0001 N79-24524 N79-24618 N79-24816
EX-76-C-09-0819 N79-24524
EX-76-C-14-2170 N79-24133
EX-76-S-02-1340 N79-24622
EY-76-S-02-2421 N79-24132
EY-76-S-02-2482 N79-24588
EY-76-S-02-2564 N79-24506
EY-76-S-02-3084 N79-24383
EY-77-C-03-1329 N79-24423
FG-77-C-01-4049 N79-24494
FOA-010-1431 N79-24703
F04071-77-C-0166 N79-24049
F04701-77-C-0078 N79-23989
F04701-77-C-0116 N79-23998
F04701-77-C-0166 N79-24050 N79-24051
F04701-78-C-0079 N79-24010 N79-24826
F19628-76-C-0003 N79-24577
F19628-76-C-0010 N79-24422
F19628-76-C-0013 N79-24668
F19628-76-C-0246 N79-24017
F19628-76-C-0256 N79-24587
F19628-77-C-0243 N79-24580
F19628-78-C-0001 N79-24419
F19628-78-C-0002 N79-24221 N79-24238 N79-24578 N79-24763
F29601-78-C-0019 N79-23951
F30602-75-C-0122 N79-24236
F30602-77-C-0118 N79-24360
F30602-77-C-0153 N79-24268
F30602-77-C-0181 N79-24825
F30602-78-C-0011 N79-24275
F33615-73-C-3051 N79-23978
F33615-75-C-2073 N79-23974
F33615-75-C-5209 N79-24163
F33615-76-C-1322 N79-24667
F33615-76-C-2038 N79-24355
F33615-76-C-3099 N79-23947
F33615-76-C-5075 N79-24034
F33615-76-C-5205 N79-24155 N79-24156
F33615-76-C-5258 N79-24034
F33615-77-C-0033 N79-24673
F33615-77-C-1030 N79-24827
F33615-77-C-1158 N79-24666
F33615-77-C-1167 N79-23958
F33615-77-C-3100 N79-24356
F33615-77-C-5123 N79-24069
F33615-78-C-1477 N79-24333
F44620-74-C-0017 N79-24060
F49620-76-C-0002 N79-24814
F49620-77-C-0048 N79-24174
F49620-77-C-0076 N79-24336
F49620-77-C-0113 N79-24055
F49620-78-C-0029 N79-23926
F49620-78-C-0041 N79-23972
JPL PROJ. 5101-100 N79-24459
JPL PROJ. 5102-78 N79-24460 N79-24461
JPL PROJ. 5102-106 N79-24466
JPL PROJ. 5102-107 N79-24465
JPL PROJ. 5103-36 N79-24462
JPL PROJ. 5104-26 N79-24464
JPL-954331 N79-24472
JPL-954356 N79-24453
JPL-954376 N79-24473
JPL-954521 N79-24452
JPL-954685 N79-24447
JPL-954786 N79-24450
JPL-954824 N79-24352
JPL-954862 N79-24448
JPL-954873 N79-24469
JPL-954876 N79-24351
JPL-954877 N79-24470
JPL-954887 N79-24451
JPL-954995 N79-24471
JPL-955006 N79-24449
JPL-955217 N79-24454
JPL-955278 N79-24455
JPL-955307 N79-24456
JPL-955368 N79-24213 N79-24420
MIN-DEP/PE-AT/2057/042 N79-23938
NASA ORDER H-30093-B N79-24658
NASA ORDER RA-32035-B N79-24875
NASA ORDER S-39193-B N79-24284
NASW-2790 N79-24565
NASW-2893 N79-23987
NASW-3035 N79-24915 N79-24916
NASW-3120 N79-24572
NASW-3198 N79-24065 N79-24323 N79-24632 N79-24694 N79-24920
NASW-3199 N79-23910 N79-23994 N79-23995 N79-24097 N79-24439 N79-24564 N79-24630 N79-24696 N79-24888
NAS1-10282 N79-24631
NAS1-12527 N79-24302
NAS1-13500 N79-23923
NAS1-14459 N79-23948
NAS1-14727 N79-24261
NAS1-15204 N79-23997
NAS1-15644 N79-24066
NAS2-9291 N79-24298
NAS3-18546 N79-24373
NAS3-18943 N79-23970
NAS3-20073 N79-24121
NAS3-20815 N79-23940 N79-24172
NAS3-21048 N79-24049 N79-24051
NAS3-21050 N79-24011 N79-24012
NAS5-22916 N79-24329
NAS5-24163 N79-24929
NAS5-24300 N79-23996
NAS5-24360 N79-24892
NAS5-24479 N79-24412
NAS7-100 N79-24039 N79-24197 N79-24213 N79-24259 N79-24351 N79-24352 N79-24420 N79-24457 N79-24458 N79-24459 N79-24460 N79-24461 N79-24462 N79-24463 N79-24464 N79-24465 N79-24466 N79-24469 N79-24757
NAS8-31904 N79-24349
NAS8-32087 N79-24258
NAS8-32091 N79-24437
NAS8-32246 N79-24438
NAS8-32356 N79-24932
NAS8-32422 N79-24295
NAS8-32538 N79-24417
NAS8-32801 N79-24919
NAS9-12032 N79-24642
NAS9-12932 N79-24633 N79-24634 N79-24635 N79-24636 N79-24637 N79-24638 N79-24639 N79-24640 N79-24641 N79-24643 N79-24644 N79-24645
NAS9-14523 N79-24634
NAS9-14776 N79-24299
NAS9-15445 N79-23992
NAS9-15466 N79-24410 N79-24415
NAS9-15476 N79-24416
NAS9-15800 N79-24411 N79-24672 N79-24697
NBS-5-35717 N79-24199
NCA2-OR-685-803 N79-23909
NGL-22-009-124 N79-24695
NGR-03-002-107 N79-24792
NGR-06-002-191 N79-24296 N79-24297
NGR-09-010-064 N79-24771
NGR-09-015-196 N79-24821
NGR-14-005-181 N79-24569 N79-24570 N79-24571
NGR-21-002-224 N79-24792 N79-24935
NGR-21-002-316 N79-24792 N79-24935
NIDA-H-81-DA-01931 N79-24718
NIDA-R-01-DA-01765 N79-24718
NR PROJ. 036-099 N79-24129
NR PROJ. 051-258 N79-24795
NR PROJ. 051-622 N79-24100

NRC-04-75-182 N79-24361
NRC-04-76-12 N79-24141
NSF AER-75-03779 N79-24518
NSF AER-75-20501 N79-24516
NSF AER-75-23453 N79-24514
NSF ATM-75-10717 N79-24612
NSF ATM-76-21017 N79-24622
NSF CHE-77-22152 N79-24100
NSF ENG-73-03729-A02 N79-24700
NSF ENG-75-15227 N79-24648
NSF ENG-76-19806 N79-24621
NSF ENG-77-19971 N79-24237
NSF ENV-77-23687 N79-24596
NSF MCS-75-22255 N79-24674
NSF PHY-77-25279 N79-24793
NSG-1357 N79-23924
NSG-1364 N79-24067
NSG-1437 N79-23921
NSG-1484 N79-24568
NSG-1509 N79-24769
NSG-1523 N79-24418
NSG-1581 N79-24791
NSG-2228 N79-24567
NSG-3097 N79-24046
NSG-3145 N79-24040
NSG-3150 N79-24007 N79-24008
NSG-3166 N79-24038
NSG-5049 N79-24671
NSG-7162 N79-24930 N79-24931
NSG-7408 N79-24925
N01-LM-6-4755 N79-24676 N79-24677
N01-LM-8-4726 N79-24252
N00014-70-C-0294 N79-24177
N00014-72-C-0234 N79-24840
N00014-75-C-0265 N79-24129
N00014-75-C-0293 N79-24226
N00014-75-C-0397 N79-24795
N00014-75-C-0419 N79-24125
N00014-75-C-0547 N79-24647
N00014-75-C-0632 N79-24271
N00014-75-C-0685 N79-24165
N00014-75-C-0705 N79-24173
N00014-75-C-0772 N79-24876
N00014-75-C-1155 N79-24824
N00014-75-C-1183 N79-24225 N79-24237
N00014-76-C-0008 N79-24718
N00014-76-C-0071 N79-24357
N00014-76-C-0288 N79-24776
N00014-76-C-0370 N79-24674
N00014-76-C-0657 N79-24159
N00014-76-C-0745 N79-24105
N00014-76-C-0783 N79-24762
N00014-76-C-0838 N79-24100 N79-24796 N79-24797
N00014-76-C-1094 N79-24585
N00014-77-C-0046 N79-24130
N00014-77-C-0102 N79-24332
N00014-77-C-0403 N79-24265
N00014-77-C-0480 N79-24675
N00014-77-C-0790 N79-24166
N00014-78-C-0098 N79-24354
N00014-78-C-0336 N79-24230
N00014-78-C-0449 N79-24794
N00014-78-C-0499 N79-24337 N79-24338
N00014-78-C-0500 N79-24583
N00014-78-G-003 N79-24586
N00019-78-C-0064 N79-24234
N00123-75-C-1294 N79-24262 N79-24263
N00173-77-C-0008 N79-24775
N00173-77-C-0222 N79-24330
N00173-78-C-0160 N79-24576
N00173-78-C-0470 N79-24333
N00228-78-C-3127 N79-24611
N60921-78-C-0049 N79-24377
N62269-76-C-0554 N79-24211 N79-24214 N79-24215 N79-24216 N79-24217 N79-24229
N62269-77-C-0351 N79-24126
N62269-77-R-0389 N79-23954 N79-23955
N66001-78-C-0051 N79-24218
OWRT PROJ. A-046-WJ(3) N79-24427
OWRT PROJ. A-048-WJ(6) N79-24428
OWRT PROJ. A-055-WHEX(1) N79-24426
OWRT PROJ. B-161-COLO(5)-PT-1 N79-24903
OWRT PROJ. B-161-COLO(5)-PT-2 N79-24904
OWRT PROJ. 7545(1) N79-24110
PROJ. SF52-552 N79-24775
PROJ. 2319-25 N79-24473
RR0210346 N79-24277
SF32392501 N79-24377
SRC-B/EG/71746 N79-24312
SRI PROJ. PYU-4928 N79-24159
SRI PROJ. 4979 N79-24232
SWED-NSRC-G-0223-06 N79-24525
W-31-109-ENG-38 N79-24480 N79-24482 N79-24483 N79-24484 N79-24494 N79-24495 N79-24508 N79-24523 N79-24899
W-7405-ENG-26 N79-24188 N79-24489 N79-24626 N79-24842 N79-24843
W-7405-ENG-36 N79-24478 N79-24589 N79-24801 N79-24879
W-7405-ENG-45 N79-24894
W-7405-ENG-48 N79-24476 N79-24479 N79-24490 N79-24503 N79-24507 N79-24617 N79-24727 N79-24877
W-7405-ENG-82 N79-24764
W-7405-ENG-92-094 N79-24799
ZF54581001 N79-24235
ZF61112001 N79-24219
501-08-10-02 N79-24631
505-02-23-01 N79-23889
505-03-13-11 N79-24773
505-04 N79-23967
505-10-23 N79-23977
505-11-24 N79-23979 N79-24654
506-25-33-04 N79-24921
510-53-02 N79-24121
517-53-13-04 N79-24372
517-53-43-01 N79-23888

REPORT / ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-7538 ..... N79-23977*#
A-7793 ..... N79-23922*#

AC-46 ..... N79-24525 #

ACC-SEIP-012 ..... N79-23941 #

AD-A061766 ..... N79-23932 #
AD-A061767 ..... N79-23933 #
AD-A061860 ..... N79-23934 #
AD-A061861 ..... N79-23931 #
AD-A062310 ..... N79-24580 #
AD-A062423 ..... N79-24129 #
AD-A062491 ..... N79-24128 #
AD-A062528 ..... N79-24325 #
AD-A062689 ..... N79-24700 #
AD-A062698 ..... N79-24127 #
AD-A062821 ..... N79-23942 #
AD-A062828 ..... N79-24826 #
AD-A062851 ..... N79-24827 #
AD-A062880 ..... N79-24876 #
AD-A062916 ..... N79-24775 #
AD-A062957 ..... N79-24701 #
AD-A062966 ..... N79-24275 #
AD-A063002 ..... N79-24104 #
AD-A063013 ..... N79-24581 #
AD-A063089 ..... N79-24232 #
AD-A063143 ..... N79-24613 #
AD-A063761 ..... N79-24582 #
AD-A063856 ..... N79-24647 #
AD-A063887 ..... N79-24422 #
AD-A063958 ..... N79-24656 #
AD-A064080 ..... N79-24380 #
AD-A064305 ..... N79-23985 #
AD-A064679 ..... N79-24231 #
AD-A065500 ..... N79-24155 #
AD-A065512 ..... N79-24269 #
AD-A065515 ..... N79-24228 #
AD-A065517 ..... N79-24612 #
AD-A065518 ..... N79-24157 #
AD-A065520 ..... N79-24223 #
AD-A065521 ..... N79-24156 #
AD-A065525 ..... N79-24222 #
AD-A065527 ..... N79-24099 #
AD-A065531 ..... N79-24794 #
AD-A065537 ..... N79-24272 #
AD-A065544 ..... N79-24264 #
AD-A065545 ..... N79-24611 #
AD-A065550 ..... N79-24577 #
AD-A065553 ..... N79-24353 #
AD-A065554 ..... N79-24355 #
AD-A065557 ..... N79-23953 #
AD-A065561 ..... N79-24377 #
AD-A065566 ..... N79-24774 #
AD-A065570 ..... N79-23952 #
AD-A065574 ..... N79-24578 #
AD-A065583 ..... N79-24825 #
AD-A065584 ..... N79-24163 #
AD-A065585 ..... N79-24226 #
AD-A065586 ..... N79-24214 #
AD-A065587 ..... N79-24215 #
AD-A065588 ..... N79-24229 #
AD-A065589 ..... N79-24216 #
AD-A065590 ..... N79-24217 #
AD-A065591 ..... N79-24211 #
AD-A065594 ..... N79-23927 #
AD-A065595 ..... N79-24102 #
AD-A065617 ..... N79-24060 #
AD-A065622 ..... N79-24575 #
AD-A065627 ..... N79-24221 #
AD-A065630 ..... N79-24726 #
AD-A065631 ..... N79-24069 #
AD-A065633 ..... N79-24379 #
AD-A065637 ..... N79-24674 #
AD-A065640 ..... N79-24673 #
AD-A065642 ..... N79-24324 #
AD-A065643 ..... N79-24360 #
AD-A065645 ..... N79-23926 #
AD-A065646 ..... N79-24059 #
AD-A065666 ..... N79-24304 #
AD-A065667 ..... N79-24303 #
AD-A065668 ..... N79-24761 #
AD-A065670 ..... N79-24271 #
AD-A065671 ..... N79-24335 #
AD-A065673 ..... N79-24823 #
AD-A065674 ..... N79-24123 #
AD-A065679 ..... N79-24795 #
AD-A065696 ..... N79-23972 #
AD-A065697 ..... N79-24220 #
AD-A065699 ..... N79-24762 #
AD-A065735 ..... N79-24262 #
AD-A065736 ..... N79-24263 #
AD-A065738 ..... N79-24699 #
AD-A065741 ..... N79-24174 #
AD-A065743 ..... N79-24331 #
AD-A065761 ..... N79-24173 #
AD-A065764 ..... N79-24681 #
AD-A065766 ..... N79-24574 #
AD-A065802 ..... N79-24218 #
AD-A065809 ..... N79-24266 #
AD-A065822 ..... N79-23984 #
AD-A065824 ..... N79-24265 #
AD-A065835 ..... N79-24893 #
AD-A065836 ..... N79-24336 #
AD-A065866 ..... N79-23989 #
AD-A065883 ..... N79-24889 #
AD-A065885 ..... N79-24330 #
AD-A065890 ..... N79-24270 #
AD-A065899 ..... N79-24356 #
AD-A065912 ..... N79-24890 #
AD-A065915 ..... N79-24158 #
AD-A065923 ..... N79-24354 #
AD-A065924 ..... N79-24357 #
AD-A065926 ..... N79-24333 #
AD-A065932 ..... N79-23941 #
AD-A065933 ..... N79-24219 #
AD-A065935 ..... N79-23949 #
AD-A065936 ..... N79-23950 #
AD-A065937 ..... N79-24378 #
AD-A065941 ..... N79-24159 #
AD-A065942 ..... N79-24576 #
AD-A065945 ..... N79-24126 #
AD-A065962 ..... N79-24070 #
AD-A065965 ..... N79-24122 #
AD-A065966 ..... N79-24655 #
AD-A065967 ..... N79-24162 #
AD-A065968 ..... N79-24160 #
AD-A065986 ..... N79-24824 #
AD-A065988 ..... N79-23973 #
AD-A065992 ..... N79-23928 #
AD-A065993 ..... N79-23929 #
AD-A065995 ..... N79-24267 #
AD-A065997 ..... N79-24268 #
AD-A066038 ..... N79-23951 #
AD-A066043 ..... N79-24332 #
AD-A066045 ..... N79-24814 #
AD-A066062 ..... N79-24124 #

AD-A066064 ..... N79-24273 #
AD-A066079 ..... N79-24164 #
AD-A066082 ..... N79-24125 #
AD-A066083 ..... N79-24100 #
AD-A066085 ..... N79-24101 #
AD-A066086 ..... N79-24334 #
AD-A066088 ..... N79-24718 #
AD-A066092 ..... N79-23974 #
AD-A066093 ..... N79-23975 #
AD-A066094 ..... N79-24224 #
AD-A066095 ..... N79-23930 #
AD-A066097 ..... N79-24230 #
AD-A066102 ..... N79-24227 #
AD-A066108 ..... N79-24305 #
AD-A066110 ..... N79-24225 #
AD-A066115 ..... N79-24474 #
AD-A066117 ..... N79-24161 #
AD-A066118 ..... N79-24103 #
AD-A066119 ..... N79-24175 #
AD-A066122 ..... N79-23976 #
AD-A066129 ..... N79-24278 #
AD-A066138 ..... N79-23958 #
AD-A066139 ..... N79-24236 #
AD-A066141 ..... N79-23956 #
AD-A066142 ..... N79-24675 #
AD-A066143 ..... N79-24276 #
AD-A066149 ..... N79-24177 #
AD-A066150 ..... N79-24840 #
AD-A066152 ..... N79-24237 #
AD-A066153 ..... N79-24797 #
AD-A066155 ..... N79-24337 #
AD-A066156 ..... N79-24338 #
AD-A066159 ..... N79-24584 #
AD-A066160 ..... N79-24585 #
AD-A066172 ..... N79-23954 #
AD-A066173 ..... N79-23955 #
AD-A066175 ..... N79-24233 #
AD-A066178 ..... N79-24235 #
AD-A066182 ..... N79-24796 #
AD-A066183 ..... N79-24165 #
AD-A066191 ..... N79-24798 #
AD-A066194 ..... N79-24828 #
AD-A066195 ..... N79-24682 #
AD-A066196 ..... N79-24841 #
AD-A066199 ..... N79-24776 #
AD-A066201 ..... N79-24277 #
AD-A066202 ..... N79-24169 #
AD-A066217 ..... N79-24058 #
AD-A066218 ..... N79-24614 #
AD-A066221 ..... N79-24475 #
AD-A066241 ..... N79-24666 #
AD-A066245 ..... N79-24239 #
AD-A066247 ..... N79-23998 #
AD-A066250 ..... N79-24763 #
AD-A066252 ..... N79-24166 #
AD-A066253 ..... N79-24238 #
AD-A066257 ..... N79-24130 #
AD-A066289 ..... N79-24587 #
AD-A066297 ..... N79-24198 #
AD-A066298 ..... N79-24667 #
AD-A066304 ..... N79-24583 #
AD-A066323 ..... N79-24381 #
AD-A066330 ..... N79-24234 #
AD-A066334 ..... N79-24168 #
AD-A066335 ..... N79-24167 #
AD-A066336 ..... N79-24586 #
AD-A066342 ..... N79-24105 #
AD-A066344 ..... N79-24668 #
AD-A066345 ..... N79-24719 #

AD-E000267 ..... N79-24277 #
AD-E000272 ..... N79-24235 #
AD-E000273 ..... N79-24233 #
AD-E100187 ..... N79-24239 #
AD-E200233 ..... N79-23951 #
AD-E200238 ..... N79-24267 #
AD-E300453 ..... N79-24058 #
AD-E300460 ..... N79-24227 #
AD-E300469 ..... N79-24224 #
AD-E300470 ..... N79-23930 #
AD-E400276 ..... N79-24103 #
AD-E400277 ..... N79-24305 #
AD-E400280 ..... N79-24161 #
AD-E430186 ..... N79-24175 #

AEDC-TR-78-64 ..... N79-23927 #

AEDC-TSR-78-P48 ..... N79-23984 #

AEROCHEM-TR-206 ..... N79-24448*#

AERONOMY-82 ..... N79-24569*#
AERONOMY-83 ..... N79-24570*#
AERONOMY-84 ..... N79-24571*#

AFAL-TR-78-92 ..... N79-24827 #
AFAL-TR-78-96 ..... N79-24667 #
AFAL-TR-78-134 ..... N79-24666 #
AFAL-TR-78-168 ..... N79-23958 #

AFAPL-TR-78-6-PT-2 ..... N79-24355 #
AFAPL-TR-78-9 ..... N79-24356 #

AFATL-TR-78-86 ..... N79-24164 #

AFFDL-TR-78-78-FBA ..... N79-24157 #

AFFDL-TR-78-35-VOL-1 ..... N79-23947 #
AFFDL-TR-78-170 ..... N79-24379 #
AFFDL-TR-78-188 ..... N79-23956 #

AFGL-APSC-403 ..... N79-24582 #

AFGL-APSG-398 ..... N79-24613 #

AFGL-TR-78-0123 ..... N79-24581 #
AFGL-TR-78-0240 ..... N79-24613 #
AFGL-TR-78-0263 ..... N79-24577 #
AFGL-TR-78-0281 ..... N79-24422 #
AFGL-TR-78-0287 ..... N79-24580 #
AFGL-TR-78-0289 ..... N79-24582 #
AFGL-TR-78-0292 ..... N79-24587 #
AFGL-TR-78-0312 ..... N79-24668 #
AFGL-TR-79-0082 ..... N79-24001*#

AFHRL-TR-78-52 ..... N79-23985 #
AFHRL-TR-78-81 ..... N79-24673 #

AFIT-CI-79-116T ..... N79-24612 #

AFIT/DS/EE/78-4 ..... N79-24828 #
AFIT/DS/EE/78-6 ..... N79-24682 #
AFIT/DS/PH/78-2 ..... N79-24798 #
AFIT/DS/PH/78-3 ..... N79-24841 #
AFIT/GE/EE/78-14 ..... N79-24231 #
AFIT/GOR/SM/78D-8 ..... N79-23952 #
AFIT/GSM/SM/77S-12 ..... N79-23953 #
AFIT/GSM/SM/78S-23 ..... N79-24890 #
AFIT/GSM/SM/78S-24 ..... N79-24893 #
AFIT/GSM/SM/78S-25 ..... N79-24889 #

AFSL-TR-78-108 ..... N79-24163 #
AFSL-TR-78-114 ..... N79-24124 #
AFSL-TR-78-127-VOL-1 ..... N79-24155 #
AFSL-TR-78-127-VOL-2-APP-A-B ..... N79-24156 #
AFSL-TR-78-141 ..... N79-24168 #
AFSL-TR-78-142 ..... N79-24167 #
AFSL-TR-78-147 ..... N79-24069 #

AFOSR-78-1472TR ..... N79-24700 #
AFOSR-78-1518TR ..... N79-24127 #
AFOSR-78-1550TR ..... N79-24876 #
AFOSR-78-1566TR ..... N79-24701 #
AFOSR-78-1605TR ..... N79-23942 #
AFOSR-79-0085TR ..... N79-24336 #
AFOSR-79-0111TR ..... N79-24726 #
AFOSR-79-0113TR ..... N79-24681 #
AFOSR-79-0180TR ..... N79-24060 #
AFOSR-79-0196TR ..... N79-24059 #
AFOSR-79-0204TR ..... N79-24304 #
AFOSR-79-0205TR ..... N79-24303 #
AFOSP-79-0207TR ..... N79-24761 #
AFOSR-79-0239TR ..... N79-24123 #
AFOSR-79-0246TR ..... N79-24331 #
AFOSR-79-0247TR ..... N79-24174 #
AFOSR-79-0250TR ..... N79-23972 #
AFOSR-79-0251TR ..... N79-24699 #
AFOSR-79-0255TR ..... N79-24220 #

AFWL-TR-78-87 ..... N79-24267 #

AGARD-AR-137 ..... N79-23981 #
AGARD-AR-140 ..... N79-23957 #
AGARD-AR-142 ..... N79-23946 #

AGARD-R-675 ..... N79-24202 #

AIRESEARCH-21-2953-1 ..... N79-24121*#

AK-5280-F-11 ..... N79-23978*#

AMMRC-TR-79-1 ..... N79-24070 #

AMS-1373 ..... N79-24173 #

ANL/EES-TM-33 ..... N79-24899 #

APWL-TR-78-182 ..... N79-23951 #

AR-1 ..... N79-24469*#
AR-2 ..... N79-24332 #
AR-2 ..... N79-24900 #
AR-5 ..... N79-24913 #
AR-5 ..... N79-24915*#
AR-77-78 ..... N79-24590 #
AR-001-284 ..... N79-24772 #
AR-001-285 ..... N79-24371 #
AR-001-290 ..... N79-24374 #
AR-001-296 ..... N79-23982 #

ARA-331 ..... N79-24814 #

ARAP-383 ..... N79-24585 #

ARBRL-MR-02889 ..... N79-24175 #

ARI-RR-139 ..... N79-24330 #

ARL-AERO-NOTE-377 ..... N79-23982 #

ARL-MAT-NOTE-122 ..... N79-24122 #
ARL-MAT-NOTE-125 ..... N79-24772 #

ARL-STRUC-NOTE-445 ..... N79-24655 #

ARL-STRUC-REPT-369 ..... N79-24371 #
ARL-STRUC-REPT-371 ..... N79-24374 #

ARLCD-CR-78020-PT-2 ..... N79-24103 #

ARLCD-TR-78019 ..... N79-24161 #
ARLCD-TR-78041 ..... N79-24305 #

ARO-9965.16-C ..... N79-24099 #
ARO-12247.3-EL ..... N79-24228 #
ARO-14101.1-GS ..... N79-24325 #
ARO-15004.6-EL ..... N79-24223 #
ARO-16222.1-EL ..... N79-24236 #
ARO-113318.8-P ..... N79-24334 #

ATC-2-53500/8CRL-96-VOL-2-APP ..... N79-24156 #

ATN-7801 ..... N79-24301 #
ATN-7804 ..... N79-24300 #

ATR-79(9553)-7 ..... N79-24572*#

AVRADCOM-TR-79-12 ..... N79-23968*#
AVRADCOM-TR-79-14 ..... N79-23922*#
AVRADCOM-TR-79-18 ..... N79-23964*#
AVRADCOM-TR-79-19 ..... N79-23969*#

AVSD-0028-79-CR ..... N79-23926 #

BBC-RD-1979/6 ..... N79-24320

BBN-4037 ..... N79-24252 #
BBN-4076 ..... N79-24675 #

BDX-613-2070-REV ..... N79-24278 #
BDX-613-2099-REV ..... N79-24131 #
BDX-613-2116-REV ..... N79-24279 #
BDX-613-2122 ..... N79-24615 #

BES-1 ..... N79-24648 #

BETC-1820-1 ..... N79-24106 #

BETC/PPS-79/1 ..... N79-24189 #
BETC/RI-78/23 ..... N79-24178 #

BLL-CTO/1485-(9091.9F) N79-24832
BLL-CTO/1560-(9091.9F) N79-24563
BLL-CTO/1563-(9091.9F) N79-24831

BLL-RTS-11347 ..... N79-24074
BLL-RTS-11509 ..... N79-24341
BLL-RTS-11594 ..... N79-24144
BLL-RTS-11605 ..... N79-24113
BLL-RTS-11654 ..... N79-24521
BLL-RTS-11718 ..... N79-24321
BLL-RTS-11722 ..... N79-24064
BLL-RTS-11737 ..... N79-24112
BLL-RTS-11758 ..... N79-24345
BLL-RTS-11759 ..... N79-24347
BLL-RTS-11785 ..... N79-24096
BLL-RTS-11807 ..... N79-24346
BLL-RTS-11821 ..... N79-24348

BLL-TRANS-1368-(9022.549) N79-24601
BLL-TRANS-1369-(9022.549) N79-24600
BLL-TRANS-1370-(9022.549) N79-24322
BLL-TRANS-1389-(9022.549) N79-24602
BLL-TRANS-1392-(9022.549) N79-24603
BLL-TRANS-1393-(9022.549) N79-24604
BLL-TRANS-1394-(9022.549) N79-24605

BLS/DF-79/022A ..... N79-24678 #

BNFT-FB-M-77-05 ..... N79-24623 #
BNFT-FB-M-77-08 ..... N79-24624 #
BNFT-FB-M-78-03 ..... N79-24592 #

BNI-I-699 ..... N79-24799 #

BNI-2007 ..... N79-24142 #
BNI-2010 ..... N79-24405 #
BNI-2014 ..... N79-24382 #

BNL-24387 ..... N79-24491 #
BNL-24781 ..... N79-24504 #
BNL-24939 ..... N79-24815 #
BNL-25178 ..... N79-24616 #
BNL-25195 ..... N79-24307 #
BNL-25212 ..... N79-24492 #
BNL-25291 ..... N79-24509 #

BR65464 ..... N79-24625 #

BTS-FR-78-65 ..... N79-24892*#

CAEC-21 ..... N79-24517 #
CAEC-25 ..... N79-24423 #
CAEC-32 ..... N79-24519 #

CALSPAN-NA-5781-M-1 ..... N79-24533 #

CED-79-14 ..... N79-24907 #
CED-79-18 ..... N79-24249 #

CEL-TM-1534 ..... N79-24475 #
CEL-TM-1542 ..... N79-24198 #

CEL-TR-868 ..... N79-24474 #

CEPHAG-4/78 ..... N79-24243 #
CEPHAG-37/77 ..... N79-24240 #
CEPHAG-41/77 ..... N79-24241 #
CEPHAG-44/77 ..... N79-24777 #
CEPHAG-45/77 ..... N79-24242 #
CEPHAG-48/77 ..... N79-24778 #

CHU-CS-79-104 ..... N79-24674 #

CHU-036-099-8 ..... N79-24129 #

COMPLETION-85-PT-1 ..... N79-24903 #
COMPLETION-86-PT-2 ..... N79-24904 #

CONF-780337-8 ..... N79-24476 #
CONF-780807-12 ..... N79-24491 #
CONF-780854-3 ..... N79-24383 #
CONF-780861-1 ..... N79-24504 #
CONF-780952-29 ..... N79-24815 #
CONF-780956-3 ..... N79-24478 #
CONF-781082-1 ..... N79-24589 #
CONF-781114-11 ..... N79-24764 #
CONF-781142-3 ..... N79-24492 #
CONF-781177-1 ..... N79-24133 #
CONF-781188-1 ..... N79-24615 #
CONF-781242-1 ..... N79-24524 #
CONF-790101-2 ..... N79-24616 #

CONF-790101-4 ..... N79-24523 #
CONF-790101-10 ..... N79-24618 #
CONF-790112-3 ..... N79-24307 #
CONF-790127-2 ..... N79-24878 #
CONF-790305-2 ..... N79-24511 #
CONF-790405-3 ..... N79-24479 #
CONF-790405-4 ..... N79-24505 #
CONF-7810138-1 ..... N79-24622 #
CONF-7810135-1 ..... N79-24503 #
CONF-7810142-1 ..... N79-24509 #
CONF-7810151-1 ..... N79-24617 #
CONF-7811101-1 ..... N79-24508 #
CONF-7811119-1 ..... N79-24507 #

COO-1340-58 ..... N79-24622 #
COO-2421-5 ..... N79-24132 #
COO-2482-9 ..... N79-24588 #
COO-2564-4 ..... N79-24506 #
COO-3084-62 ..... N79-24383 #
COO-4294-2 ..... N79-24800 #

CSD-2624-ISR-2 ..... N79-24174 #

CSIR-APRG/78/1 ..... N79-24609 #
CSIR-APRG/78/2 ..... N79-24610 #

CSIR-CENG-232 ..... N79-24068 #

CSIR-FIS-174 ..... N79-24098 #

CSIR-ME-1577 ..... N79-23983 #

CSIR-R-MAG-5/17 ..... N79-24573 #

CSIR-SR-WAT-54 ..... N79-24468 #

CSIR-T-WISK-55 ..... N79-24698 #

CSIR-TWISK-54 ..... N79-24665 #

CSM/TM-79/6018 ..... N79-23996*#

CTH-IEFT/PP-1977-11 ..... N79-24339 #
CTH-IEFT/PP-1977-12 ..... N79-24845 #
CTH-IEFT/PP-1977-13 ..... N79-24846 #
CTH-IEFT/PP-1977-14 ..... N79-24847 #
CTH-IEFT/PP-1977-15 ..... N79-24848 #
CTH-IEFT/PP-1978-1 ..... N79-24849 #

CTH-MATH-1977-17 ..... N79-24703 #
CTH-MATH-1977-18 ..... N79-24720 #
CTH-MATH-1978-1 ..... N79-24728 #
CTH-MATH-1978-2 ..... N79-24704 #
CTH-MATH-1978-3 ..... N79-24729 #

DAS-M-6 ..... N79-24376 #

DCEC-TN-1-79 ..... N79-24239 #

DELCS-TR-79-1 ..... N79-24614 #

DELET-TR-75-0044-F-V-2 ..... N79-24774 #
DELET-TR-77-0526-4 ..... N79-24270 #
DELET-TR-79-2 ..... N79-24264 #
DELET-TR-79-4 ..... N79-24269 #

DGS-277 ..... N79-24422 #

DH-24 ..... N79-24619 #
DH-110T ..... N79-24637*#

DNA-4644T ..... N79-24224 #
DNA-4654F ..... N79-24058 #
DNA-4656F ..... N79-23930 #

DOE/CS-0042/3 ..... N79-24501 #
DOE/CS-0068 ..... N79-24900 #
DOE/ER-0021/1 ..... N79-24435*#
DOE/ER-0021/2 ..... N79-24436*#
DOE/ET-0074 ..... N79-24727 #
DOE/ET-4063-1-VOL-2 ..... N79-24477 #
DOE/JPL-1012-2 ..... N79-24457*#
DOE/JPL-1012-3 ..... N79-24458*#
DOE/JPL-1012-4 ..... N79-24459*#
DOE/JPL-1060-7 ..... N79-24464*#
DOE/JPL-1060-9 ..... N79-24462*#
DOE/JPL-1060-12-VOL-1 ..... N79-24460*#
DOE/JPL-1060-12-VOL-2 ..... N79-24461*#
DOE/JPL-1060-13 ..... N79-24466*#

DOE/JPL-1060-79/1 ..... N79-24465*#
DOE/JPL-954331-79/2 ..... N79-24472*#
DOE/JPL-954356-79/8 ..... N79-24453*#
DOE/JPL-954521-79/9 ..... N79-24452*#
DOE/JPL-954685-79/1 ..... N79-24447*#
DOE/JPL-954786-79/1 ..... N79-24450*#
DOE/JPL-954862-79/6 ..... N79-24448*#
DOE/JPL-954873-78/01 ..... N79-24469*#
DOE/JPL-954876-79/16 ..... N79-24351*#
DOE/JPL-954877-78/5 ..... N79-24470*#
DOE/JPL-954887-79/5 ..... N79-24451*#
DOE/JPL-954995-78/3 ..... N79-24471*#
DOE/JPL-955006-79/2 ..... N79-24449*#
DOE/JPL-955217-79/4 ..... N79-24454*#
DOE/JPL-955278-79/1 ..... N79-24455*#
DOE/JPL-955307-79/1 ..... N79-24456*#
DOE/NASA/1002-78/2 ..... N79-24445*#
DOE/NASA/1002-79/3 ..... N79-24442*#
DOE/NASA/1062-79/1 ..... N79-24440*#
DOE/NASA/2674-79/5 ..... N79-24446*#
DOE/NASA/20485-79/1 ..... N79-24443*#
DOE/US-002 ..... N79-24490 #

DOT-HS-803-706 ..... N79-24358 #

DOT-TSC-UMTA-78-33 ..... N79-24898 #

DP-MS-78-26 ..... N79-24816 #
DP-MS-78-49 ..... N79-24618 #
DP-MS-78-55 ..... N79-24524 #

DRDMI-T-79-17 ..... N79-24324 #

DRIC-BR-60444-VOL-1 ..... N79-24380 #

DRIC-TRANS-5370 ..... N79-24625 #

DTNSRDC/PAS-78-34 ..... N79-24276 #
DTNSRDC/PAS-78-35 ..... N79-24266 #

DVL-184 ..... N79-23910*#

D6-48097 ..... N79-24172*#
D6-48611 ..... N79-23940*#
D256-10529 ..... N79-24823 #

E-001 ..... N79-24000*#
E-004 ..... N79-23964*#
E-005 ..... N79-24443*#
E-006 ..... N79-23911*#
E-010 ..... N79-23965*#
E-011 ..... N79-24770*#
E-013 ..... N79-23966*#
E-016 ..... N79-24444*#
E-027 ..... N79-23912*#
E-036 ..... N79-24446*#
E-048 ..... N79-24359*#
E-052 ..... N79-24350*#
E-8958 ..... N79-23967*#
E-9883 ..... N79-24445*#
E-9935 ..... N79-23999*#
E-9947 ..... N79-23920*#
E-9958 ..... N79-23968*#
E-9982 ..... N79-23969*#
E-9984 ..... N79-23963*#
E-9996 ..... N79-24442*#

EERL-79-01 ..... N79-24596 #

EF78-121A-VOL-1 ..... N79-24531 #
EF78-121B-VOL-2 ..... N79-24532 #

EMD-78-77 ..... N79-24192 #

EPA-430/9-78-006 ..... N79-24906 #
EPA-450/2-78-047 ..... N79-24537 #
EPA-450/3-78-048 ..... N79-24579 #
EPA-450/3-78-105 ..... N79-24526 #
EPA-450/3-78-106 ..... N79-24527 #
EPA-520/5-77-004 ..... N79-24530 #
EPA-560/6-78-009 ..... N79-24111 #
EPA-560/6-79-001 ..... N79-24597 #
EPA-560/6-79-002 ..... N79-24649 #
EPA-600/2-78-196 ..... N79-24908 #
EPA-600/2-79-005 ..... N79-24544 #
EPA-600/3-79-001A-VOL-1 ..... N79-24531 #
EPA-600/3-79-001B-VOL-2 ..... N79-24532 #
EPA-600/3-79-006 ..... N79-24533 #
EPA-600/4-78-064 ..... N79-24327 #

EPA-600/5-79-002 ..... N79-24545 #
EPA-600/7-78-205 ..... N79-24543 #
EPA-600/7-78-220 ..... N79-24522 #
EPA-600/7-79-014A ..... N79-24534 #
EPA-600/7-79-027 ..... N79-24580 #
EPA-600/9-78-022 ..... N79-24535 #
EPA-600/9-79-002 ..... N79-24912 #
EPA-600/9-79-003 ..... N79-24911 #
EPA-906/9-78-002A ..... N79-24598 #
EPA-910/9-78-054A ..... N79-24528 #
EPA-910/9-78-054B ..... N79-24529 #

EPA/HCD-50 ..... N79-24906 #

ERADCOM/ASL-TR-0020 ..... N79-24575 #

ERIM-132400-16-F ..... N79-24416*#

ESD-TR-78-259 ..... N79-24578 #
ESD-TR-78-290 ..... N79-24221 #
ESD-TR-78-292 ..... N79-24763 #
ESD-TR-78-376 ..... N79-24238 #

ESDU-78032 ..... N79-24344
ESDU-78035 ..... N79-24369

ESL-(78)3815-6 ..... N79-24220 #
ESL-(78)4583-3 ..... N79-24229 #
ESL-(78)4583-5 ..... N79-24216 #
ESL-(78)4583-6 ..... N79-24217 #
ESL-(78)4583-7 ..... N79-24211 #
ESL-4583-1 ..... N79-24214 #
ESL-4583-2 ..... N79-24215 #
ESL-784583 ..... N79-24215 #

ETEC-TRANS-1 ..... N79-24384 #

E79-10190 ..... N79-24410*#
E79-10191 ..... N79-24411*#
E79-10192 ..... N79-24412*#
E79-10193 ..... N79-24413*#
E79-10194 ..... N79-24414*#
E79-10195 ..... N79-24415*#
E79-10197 ..... N79-24416*#

FAA-RD-78-109 ..... N79-23912*#

FB-27 ..... N79-24657 #
FB-28 ..... N79-24315 #

FCC/OCE/BS-79/01 ..... N79-24250 #
FCC/OCE/SAD-79/01 ..... N79-24251 #

FE-2047-8 ..... N79-24185 #
FE-2210-29 ..... N79-24306 #
FE-2251-52 ..... N79-24182 #
FE-2270-34 ..... N79-24181 #
FE-2275-8 ..... N79-24187 #
FE-2278-9 ..... N79-24179 #
FE-2338-10 ..... N79-24176 #
FE-2340-7 ..... N79-24186 #
FE-2434-29 ..... N79-24184 #
FE-2490-15 ..... N79-24190 #
FE-2565-13 ..... N79-24183 #
FE-8890 ..... N79-24488 #

FFB-W-78-03 ..... N79-24476 #

FJSRL-TR-78-0016 ..... N79-24169 #

FR-79-12-40-VOL-2 ..... N79-24774 #
FR-10632 ..... N79-23975 #

FTD-ID(RS)T-0861-78 ..... N79-23976 #
FTD-ID(RS)T-1775-78 ..... N79-23928 #
FTD-ID(RS)T-1859-78 ..... N79-23929 #

FTSRL-TR-79-0002 ..... N79-24381 #

FWS/OBS-78/16 ..... N79-24425 #

GPO-31-641 ..... N79-24467 #
GPO-42-110 ..... N79-23988 #
GPO-43-457 ..... N79-23925 #

H-1073 ..... N79-23979*#

HAC-FR-79-73-538 ..... N79-24333 #

HAC-REF-E2380 ..... N79-24333 #

HAOS-11 ..... N79-24539 #

HCP/CS-0306 ..... N79-24500 #
HCP/CS-4250-VOL-2 ..... N79-24493 #

HEDL-SA-1663 ..... N79-24133 #

HSS-B-049 ..... N79-24576 #

I-ARA-78-U-78 ..... N79-24814 #

IBR-79-1 ..... N79-24718 #

IIHR-212-VOL-2 ..... N79-24515 #

IINR-78/12 ..... N79-24541 #

IITRI-B6137-6 ..... N79-24128 #

IKE-5TF-296-79 ..... N79-24097*#

ILL-(TH)-79-14 ..... N79-24793 #

INSTAAR-7-07-83 ..... N79-24594 #

IPPJ-T-31 ..... N79-24839 #

IPPJ-367 ..... N79-24837 #
IPPJ-368 ..... N79-24836 #
IPPJ-369 ..... N79-24833 #
IPPJ-370 ..... N79-24834 #
IPPJ-374 ..... N79-24835 #

IR-1 ..... N79-24272 #
IR-2 ..... N79-24452*#

IS-M-174 ..... N79-24764 #

ISBN-0-7988-1306-7 ..... N79-24609 #
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ISD-236 ..... N79-24388 #
ISD-237 ..... N79-24389 #
ISD-238 ..... N79-24390 #
ISD-241 ..... N79-24391 #
ISD-242 ..... N79-24702 #
ISD-247 ..... N79-24392 #
ISD-248 ..... N79-24393 #

ISSN-0077-5606 ..... N79-24120 #
ISSN-0077-5606 ..... N79-24440 #
ISSN-0568-0581 ..... N79-24569*#
ISSN-0568-0581 ..... N79-24570*#
ISSN-0568-0581 ..... N79-24571*#

JPL-PUB-79-1 ..... N79-24464*#
JPL-PUB-79-7 ..... N79-24465*#
JPL-PUB-79-8-VOL-1 ..... N79-24460*#
JPL-PUB-79-8-VOL-2 ..... N79-24461*#
JPL-PUB-79-13 ..... N79-24466*#
JPL-PUB-79-14 ..... N79-24457*#
JPL-PUB-79-15 ..... N79-24458*#
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JPL-9950-85 ..... N79-24420*#

JPRS-73266 ..... N79-24938 #
JPRS-73337 ..... N79-24941 #
JPRS-73388 ..... N79-24946 #
JPRS-73404 ..... N79-23990 #

JSC-13760 ..... N79-24418*#
JSC-13761 ..... N79-24413*#
JSC-14777 ..... N79-24411*#
JSC-14805 ..... N79-24672*#
JSC-14867 ..... N79-24697*#

KA-TR-153 ..... N79-23951 #

L-12626 ..... N79-24773*#
L-12729 ..... N79-24372*#
L-12730 ..... N79-24921*#
L-12973 ..... N79-23889*#

LA-UR-78-3195 ..... N79-24589 #
LA-UR-79-6 ..... N79-24478 #

LA-7275 ..... N79-24879 #
LA-7694-PR ..... N79-24801 #

LARS-CR-022879 ..... N79-24415*#
LARS-CR-112278 ..... N79-24410*#

LBF-TR-111-VOL-1 ..... N79-24400 #

LBL-7829 ..... N79-24476 #
LBL-8596 ..... N79-24507 #
LBL-8707 ..... N79-24894 #

LC-78-26038 ..... N79-24283 #
LC-78-600162 ..... N79-24200 #

LEC-12911 ..... N79-24411*#
LEC-13068 ..... N79-24697*#
LEC-13265 ..... N79-24672*#

LEP-77/9.SHE-618-B ..... N79-24108 #
LEP-78/19.SHE-441-H ..... N79-24881 #

LFB-FB-135 ..... N79-24402 #

LFB-TR-112-VOL-2 ..... N79-24401 #

LHNCBC-78-05 ..... N79-24676 #
LHNCBC-78-06 ..... N79-24677 #
LHNCBC-79/03 ..... N79-24252 #

LID-R-904 ..... N79-24695*#

LIDS-TH-885 ..... N79-24225 #
LIDS-TH-886 ..... N79-24237 #

LMSC-HREC-TR-D568959 ..... N79-24295*#

LMSC/D673078 ..... N79-24840 #

LOG-J10753 ..... N79-24376 #

LP-170 ..... N79-24850 #

MA-ABC-5 ..... N79-24223 #

MA-252T ..... N79-24639*#

MBB-UFE-1322-0 ..... N79-23904 #
MBB-UFE-1349-0 ..... N79-23980 #
MBB-UFE-1352-0 ..... N79-23935 #
MBB-UFE-1353-0 ..... N79-23943 #
MBB-UFE-1355-0 ..... N79-24901 #
MBB-UFE-1359-0 ..... N79-23936 #
MBB-UFE-1362-0 ..... N79-23937 #

ME-95(79)ONR-414-1 ..... N79-24357 #

MERADCOM-2250 ..... N79-24158 #

MLM-2549(OP) ..... N79-24505 #
MLM-2583 ..... N79-24107 #

MRL-TR-78-11C ..... N79-24929*#

MPI-PAR-EXTRATERR-141 ..... N79-24936 #

MPIS-13/1977 ..... N79-24804 #

MPIS-16/1977 ..... N79-24134 #
MPIS-19/1977 ..... N79-24805 #

MRC-R-406 ..... N79-24227 #

MRL-TN-414 ..... N79-24162 #
MRL-TN-415 ..... N79-24160 #

MTI-78TR27 ..... N79-24356 #
MTI-79TR35 ..... N79-24354 #

MTR-7975 ..... N79-24419*#

NAC-TR-2253 ..... N79-24274 #

NADC-77112-30 ..... N79-24126 #
NADC-77123-30-VOL-1 ..... N79-23954 #
NADC-77123-30-VOL-2 ..... N79-23955 #
NADC-78257-60 ..... N79-24656 #
NADC-79041-30 ..... N79-24214 #
NADC-79042-30 ..... N79-24215 #
NADC-79043-30 ..... N79-24229 #
NADC-79044-30 ..... N79-24216 #
NADC-79045-30 ..... N79-24217 #
NADC-79046-30 ..... N79-24211 #

NAL-TR-552T ..... N79-24370 #

NASA-CASE-ARC-10977-1 ..... N79-23971*#
NASA-CASE-ARC-11058-2 ..... N79-24651*
NASA-CASE-ARC-11169-1 ..... N79-24062*
NASA-CASE-ARC-11241-1 ..... N79-24153*#

NASA-CASE-GSC-12410-1 ..... N79-24260*#

NASA-CASE-LAR-11922-1 ..... N79-24073*
NASA-CASE-LAR-12375-1 ..... N79-24203*

NASA-CASE-LEW-12933-1 ..... N79-24061*#
NASA-CASE-LEW-13122-1 ..... N79-24154*#

NASA-CASE-MSC-16841-1 ..... N79-24285*

NASA-CASE-NPO-13579-2 ..... N79-24433*
NASA-CASE-NPO-13579-3 ..... N79-24432*
NASA-CASE-NPO-13641-1 ..... N79-24210*
NASA-CASE-NPO-13652-2 ..... N79-24431*
NASA-CASE-NPO-13906-1 ..... N79-24652*
NASA-CASE-NPO-13910-1 ..... N79-24646*#
NASA-CASE-NPO-14000-1 ..... N79-24254*
NASA-CASE-NPO-14056-1 ..... N79-24257*
NASA-CASE-NPO-14152-1 ..... N79-24212*#
NASA-CASE-NPO-14596-1 ..... N79-24197*#

NASA-CP-2071 ..... N79-24001*#
NASA-CP-2085 ..... N79-23889*#
NASA-CP-2086 ..... N79-23912*#

NASA-CR-3046 ..... N79-24302*#
NASA-CR-3113 ..... N79-23948*#
NASA-CR-3118 ..... N79-23978*#
NASA-CR-3126 ..... N79-24631*#
NASA-CR-3140 ..... N79-23923*#
NASA-CR-3148 ..... N79-24261*#
NASA-CR-3154 ..... N79-23924*#
NASA-CR-12932 ..... N79-24640*#
NASA-CR-147674 ..... N79-24636*#
NASA-CR-152222 ..... N79-24875*#
NASA-CR-152267 ..... N79-24298*#
NASA-CR-157439 ..... N79-24456*#
NASA-CR-157441 ..... N79-24462*#
NASA-CR-157932 ..... N79-24821*#
NASA-CR-158483 ..... N79-24412*#
NASA-CR-158485 ..... N79-24414*#
NASA-CR-158533 ..... N79-24459*#
NASA-CR-158534 ..... N79-24464*#
NASA-CR-158536 ..... N79-24791*#
NASA-CR-158537 ..... N79-24471*#
NASA-CR-158538 ..... N79-24469*#
NASA-CR-158540 ..... N79-24213*#
NASA-CR-158543 ..... N79-24470*#
NASA-CR-158569 ..... N79-24472*#
NASA-CR-158570 ..... N79-24473*#
NASA-CR-158611 ..... N79-24792*#
NASA-CR-158618 ..... N79-24418*#
NASA-CR-158619 ..... N79-24769*#
NASA-CR-158620 ..... N79-24695*#
NASA-CR-158621 ..... N79-24935*#
NASA-CR-158631 ..... N79-24297*#

NASA-CR-158632 ..... N79-24296*#
NASA-CR-158633 ..... N79-24671*#
NASA-CR-158639 ..... N79-24465*#
NASA-CR-158640 ..... N79-24466*#
NASA-CR-158641 ..... N79-24463*#
NASA-CR-158642 ..... N79-24259*#
NASA-CR-158643 ..... N79-24460*#
NASA-CR-158644 ..... N79-24461*#
NASA-CR-158645 ..... N79-24570*#
NASA-CR-158646 ..... N79-24569*#
NASA-CR-158647 ..... N79-24571*#
NASA-CR-158648 ..... N79-24931*#
NASA-CR-158649 ..... N79-24930*#
NASA-CR-158650 ..... N79-24457*#
NASA-CR-158651 ..... N79-24458*#
NASA-CR-158652 ..... N79-24658*#
NASA-CR-158653 ..... N79-24567*#
NASA-CR-158656 ..... N79-24916*#
NASA-CR-158657 ..... N79-24915*#
NASA-CR-158658 ..... N79-23987*#
NASA-CR-158659 ..... N79-24067*#
NASA-CR-158660 ..... N79-24771*#
NASA-CR-158661 ..... N79-23921*#
NASA-CR-158662 ..... N79-24572*#
NASA-CR-158666 ..... N79-24284*#
NASA-CR-158667 ..... N79-24925*#
NASA-CR-158668 ..... N79-24452*#
NASA-CR-158669 ..... N79-24453*#
NASA-CR-158670 ..... N79-24351*#
NASA-CR-158671 ..... N79-24455*#
NASA-CR-158672 ..... N79-24454*#
NASA-CR-158673 ..... N79-24352*#
NASA-CR-158674 ..... N79-24420*#
NASA-CR-158675 ..... N79-24451*#
NASA-CR-158676 ..... N79-24450*#
NASA-CR-158677 ..... N79-24449*#
NASA-CR-158678 ..... N79-24447*#
NASA-CR-158679 ..... N79-24448*#
NASA-CR-159015 ..... N79-24419*#
NASA-CR-159018 ..... N79-23997*#
NASA-CR-159080 ..... N79-24066*#
NASA-CR-159464 ..... N79-24121*#
NASA-CR-159552 ..... N79-24373*#
NASA-CR-159566 ..... N79-23970*#
NASA-CR-159568 ..... N79-24172*#
NASA-CR-159569 ..... N79-23940*#
NASA-CR-159921 ..... N79-24929*#
NASA-CR-159926 ..... N79-24892*#
NASA-CR-159931 ..... N79-23996*#
NASA-CR-159932 ..... N79-24329*#
NASA-CR-160140 ..... N79-24416*#
NASA-CR-160143 ..... N79-24415*#
NASA-CR-160152 ..... N79-24411*#
NASA-CR-160154 ..... N79-24410*#
NASA-CR-160166 ..... N79-24299*#
NASA-CR-160176 ..... N79-23992*#
NASA-CR-160178 ..... N79-24672*#
NASA-CR-160183 ..... N79-24697*#
NASA-CR-160188 ..... N79-24634*#
NASA-CR-160206 ..... N79-24633*#
NASA-CR-160217 ..... N79-24637*#
NASA-CR-160220 ..... N79-24638*#
NASA-CR-160221 ..... N79-24639*#
NASA-CR-160225 ..... N79-24635*#
NASA-CR-160226 ..... N79-24641*#
NASA-CR-160228 ..... N79-24645*#
NASA-CR-160230 ..... N79-24643*#
NASA-CR-160231 ..... N79-24644*#
NASA-CR-160235 ..... N79-24642*#
NASA-CR-161191 ..... N79-24438*#
NASA-CR-161204 ..... N79-24437*#
NASA-CR-161205 ..... N79-24349*#
NASA-CR-161224 ..... N79-24295*#
NASA-CR-161225 ..... N79-24417*#
NASA-CR-161226 ..... N79-24919*#
NASA-CR-161233 ..... N79-24932*#
NASA-CR-161234 ..... N79-24258*#

NASA-NEWS-RELEASE-79-73 ..... N79-23986*

NASA-RP-1037 ..... N79-24921*#

NASA-TM-72861 ..... N79-23979*#
NASA-TM-72864 ..... N79-24654*#
NASA-TM-75384 ..... N79-23910*#
NASA-TM-75391 ..... N79-24630*#
NASA-TM-75398 ..... N79-24097*#
NASA-TM-75412 ..... N79-24888*#
NASA-TM-75413 ..... N79-24323*#
NASA-TM-75426 ..... N79-24065*#
NASA-TM-75435 ..... N79-24564*#
NASA-TM-75452 ..... N79-24632*#
NASA-TM-75481 ..... N79-24920*#
NASA-TM-75613 ..... N79-23994*#
NASA-TM-75614 ..... N79-23995*
NASA-TM-75615 ..... N79-24565*#
NASA-TM-75616 ..... N79-24696*#
NASA-TM-75617 ..... N79-24694*#
NASA-TM-75619 ..... N79-24934*#
NASA-TM-75634 ..... N79-24439*#
NASA-TM-78215 ..... N79-24441*#
NASA-TM-78570 ..... N79-23909*#
NASA-TM-78575 ..... N79-23977*#
NASA-TM-78580 ..... N79-23922*#
NASA-TM-78818 ..... N79-23888*#
NASA-TM-79067 ..... N79-24445*#
NASA-TM-79109 ..... N79-23999*#
NASA-TM-79123 ..... N79-23968*#
NASA-TM-79134 ..... N79-23969*#
NASA-TM-79136 ..... N79-23963*#
NASA-TM-79143 ..... N79-24442*#
NASA-TM-79146 ..... N79-24000*#
NASA-TM-79148 ..... N79-23964*#
NASA-TM-79149 ..... N79-24443*#
NASA-TM-79150 ..... N79-23911*#
NASA-TM-79154 ..... N79-23965*#
NASA-TM-79155 ..... N79-24770*#
NASA-TM-79157 ..... N79-23966*#
NASA-TM-79160 ..... N79-24444*#
NASA-TM-79171 ..... N79-23920*#
NASA-TM-79172 ..... N79-24446*#
NASA-TM-79180 ..... N79-24359*#
NASA-TM-79185 ..... N79-24350*#
NASA-TM-79689 ..... N79-24421*#
NASA-TM-80250 ..... N79-24731*#
NASA-TM-80354 ..... N79-24435*#
NASA-TM-80355 ..... N79-24436*#
NASA-TM-80431 ..... N79-24413*#
NASA-TM-80465 ..... N79-24568*#

NASA-TP-1399 ..... N79-23967*#
NASA-TP-1430 ..... N79-24773*#
NASA-TP-1447 ..... N79-24372*#

NASA-TT-F-765 ..... N79-23908*#

NBS-GCR-78-134 ..... N79-24199 #

NBS-SP-400/53 ..... N79-24283 #

NBS-TN-1008 ..... N79-24253 #

NBS/MONO-163 ..... N79-24200 #

NBSIR-78-896 ..... N79-24595 #
NBSIR-78-1507 ..... N79-24282 #
NBSIR-78-1576 ..... N79-24658*#
NBSIR-78-1581 ..... N79-24362 #
NBSIR-78-1590 ..... N79-24284*#

NEDO-21-78 ..... N79-24353 #

NEPRF-CR-78-01 ..... N79-24611 #

NLM/LHC-TR-7801 ..... N79-24676 #

NLM/LHC-TR-7802 ..... N79-24677 #

NOAA-TM-ERL-ARL-73 ..... N79-24513 #

NOAA-79020801 ..... N79-24513 #
NOAA-79021401 ..... N79-24913 #

NOSC-TR-254 ..... N79-24218 #

NRC/CNR-TT-1929 ..... N79-24440 #
NRC/CNR-TT-1930 ..... N79-24120 #

NRL-MR-3906 ..... N79-24277 #
NRL-MR-3909 ..... N79-24233 #
NRL-MR-3919 ..... N79-24235 #
NRL-MR-3939-PT-1 ..... N79-24875*#

NRTC-79-TR-VOL-1 ..... N79-24337 #
NRTC-79-TR-VOL-2 ..... N79-24338 #

NSF/RA-780370 ..... N79-24905 #
NSF/RA-780381 ..... N79-24516 #

NSF/RA-780382 ..... N79-24518 #
NSF/RA-780383 ..... N79-24519 #
NSF/RANN/AER75-20501/PR/78/1 ..... N79-24516 #

NSWC/WOL/TR-78-30 ..... N79-24219 #
NSWC/WOL/TR-78-120 ..... N79-24164 #

NTIA/REPORT-78/11 ..... N79-24248 #
NTIA/REPORT-78/12 ..... N79-24247 #

NTIS/PS-75/049 ..... N79-24135 #
NTIS/PS-75/105 ..... N79-24430 #
NTIS/PS-75/168 ..... N79-23939 #
NTIS/PS-75/179 ..... N79-24139 #
NTIS/PS-75/190 ..... N79-24280 #
NTIS/PS-75/320 ..... N79-24650 #
NTIS/PS-75/749 ..... N79-24135 #
NTIS/PS-76/0039 ..... N79-23945 #
NTIS/PS-76/0041 ..... N79-24319 #
NTIS/PS-76/0042 ..... N79-23960 #
NTIS/PS-76/0043 ..... N79-23962 #
NTIS/PS-76/0055 ..... N79-24430 #
NTIS/PS-76/0070 ..... N79-24430 #
NTIS/PS-76/0072 ..... N79-23939 #
NTIS/PS-76/0108 ..... N79-24140 #
NTIS/PS-76/0109 ..... N79-24139 #
NTIS/PS-76/0114 ..... N79-24143 #
NTIS/PS-76/0122 ..... N79-24280 #
NTIS/PS-76/0123 ..... N79-24281 #
NTIS/PS-76/0175 ..... N79-24780 #
NTIS/PS-76/0176 ..... N79-24201 #
NTIS/PS-76/0177 ..... N79-24650 #
NTIS/PS-77/0004 ..... N79-24135 #
NTIS/PS-77/0006 ..... N79-24137 #
NTIS/PS-77/0034 ..... N79-24319 #
NTIS/PS-77/0035 ..... N79-23945 #
NTIS/PS-77/0062 ..... N79-24404 #
NTIS/PS-77/0067 ..... N79-23939 #
NTIS/PS-77/0081 ..... N79-24430 #
NTIS/PS-77/0126 ..... N79-23960 #
NTIS/PS-77/0158 ..... N79-24280 #
NTIS/PS-77/0159 ..... N79-24281 #
NTIS/PS-77/0160 ..... N79-24139 #
NTIS/PS-77/0161 ..... N79-24140 #
NTIS/PS-77/0171 ..... N79-24650 #
NTIS/PS-77/0183 ..... N79-24143 #
NTIS/PS-77/0218 ..... N79-24780 #
NTIS/PS-77/0219 ..... N79-24201 #
NTIS/PS-77/0224 ..... N79-23962 #
NTIS/PS-78/0064 ..... N79-23945 #
NTIS/PS-78/0070 ..... N79-24430 #
NTIS/PS-78/0096 ..... N79-24135 #
NTIS/PS-78/0097 ..... N79-24137 #
NTIS/PS-78/0120 ..... N79-24650 #
NTIS/PS-78/0122 ..... N79-23939 #
NTIS/PS-78/0149 ..... N79-24404 #
NTIS/PS-78/0165 ..... N79-24316 #
NTIS/PS-78/0166 ..... N79-24318 #
NTIS/PS-78/0174 ..... N79-24280 #
NTIS/PS-78/0175 ..... N79-24281 #
NTIS/PS-78/0188 ..... N79-24319 #
NTIS/PS-78/0199 ..... N79-24139 #
NTIS/PS-78/0201 ..... N79-24140 #
NTIS/PS-78/0233 ..... N79-24143 #
NTIS/PS-78/0238 ..... N79-24780 #
NTIS/PS-78/0239 ..... N79-24201 #
NTIS/PS-78/0289 ..... N79-23960 #
NTIS/PS-78/0290 ..... N79-23962 #
NTIS/PS-79/0142/4 ..... N79-24280 #
NTIS/PS-79/0143/2 ..... N79-24281 #
NTIS/PS-79/0166/3 ..... N79-23939 #
NTIS/PS-79/0177/0 ..... N79-24135 #
NTIS/PS-79/0178/8 ..... N79-24136 #
NTIS/PS-79/0179/6 ..... N79-24137 #
NTIS/PS-79/0180/4 ..... N79-24138 #
NTIS/PS-79/0190/3 ..... N79-24650 #
NTIS/PS-79/0206/7 ..... N79-24430 #
NTIS/PS-79/0208/3 ..... N79-24143 #
NTIS/PS-79/0220/8 ..... N79-24139 #
NTIS/PS-79/0221/6 ..... N79-24140 #
NTIS/PS-79/0232/3 ..... N79-24316 #
NTIS/PS-79/0233/1 ..... N79-24317 #
NTIS/PS-79/0238/9 ..... N79-24318 #
NTIS/PS-79/0244/8 ..... N79-23945 #
NTIS/PS-79/0259/6 ..... N79-24319 #
NTIS/PS-79/0264/6 ..... N79-24780 #
NTIS/PS-79/0265/3 ..... N79-24201 #
NTIS/PS-79/0269/5 ..... N79-24403 #
NTIS/PS-79/0270/3 ..... N79-24404 #

NTIS/PS-79/0312/3 ..... N79-23959 #
NTIS/PS-79/0313/1 ..... N79-23960 #
NTIS/PS-79/0314/9 ..... N79-23961 #
NTIS/PS-79/0315/6 ..... N79-23962 #

NTPSC/SR-78/03 ..... N79-24246 #

NUREG-CR-0518 ..... N79-24405 #
NUREG-CR-0542 ..... N79-24141 #
NUREG-CR-0581 ..... N79-24361 #
NUREG-CR-0582 ..... N79-24142 #
NUREG-CR-0583 ..... N79-24382 #

OAQPS-1.2-116 ..... N79-24537 #

ORNL/CON-30 ..... N79-24489 #
ORNL/ENG/TM-13-VOL-1 ..... N79-24188 #
ORNL/TM-6704 ..... N79-24843 #
ORNL/TM-6743 ..... N79-24842 #

OUEL-1194/77 ..... N79-24706 #
OUEL-1196/77 ..... N79-24311 #
OUEL-1201/77 ..... N79-24683 #
OUEL-1212/77 ..... N79-24396 #
OUEL-1214/77 ..... N79-24902 #
OUEL-1223/77 ..... N79-24707 #
OUEL-1225/78 ..... N79-24312 #
OUEL-1232/78 ..... N79-24397 #
OUEL-1235/78 ..... N79-23938 #
OUEL-1237/78 ..... N79-24398 #
OUEL-1238/78 ..... N79-24313 #
OUEL-1240/78 ..... N79-24724 #
OUEL-1241/78 ..... N79-24620 #
OUEL-1243/78 ..... N79-24829 #
OUEL-1244/78 ..... N79-24399 #
OUEL-1245/78 ..... N79-24314 #
OUEL-1248/78 ..... N79-24326 #
OUEL-1251/78 ..... N79-24887 #

OWRT-A-034-WVA(1) ..... N79-24914 #
OWRT-A-044-RE(1) ..... N79-24536 #
OWRT-A-077-OKLA(1) ..... N79-24542 #
OWRT-A-096-NC(1) ..... N79-24891 #

OWRT-B-109-COLO(8) ..... N79-24429 #

OWRT-C-6011(5201)(3)-VOL-2 ..... N79-24515 #
OWRT-C-6106(5213)(7) ..... N79-24538 #

PAPER-810870 ..... N79-24580 #

PB-290467/0 ..... N79-24593 #
PB-290473/8 ..... N79-24543 #
PB-290475/3 ..... N79-24678 #
PB-290491/0 ..... N79-24282 #
PB-290505/7 ..... N79-24528 #
PB-290506/5 ..... N79-24529 #
PB-290507/3 ..... N79-24531 #
PB-290508/1 ..... N79-24532 #
PB-290514/9 ..... N79-24534 #
PB-290516/4 ..... N79-24358 #
PB-290529/7 ..... N79-24514 #
PB-290558/6 ..... N79-24535 #
PB-290561/0 ..... N79-24536 #
PB-290569/3 ..... N79-24193 #
PB-290571/9 ..... N79-24425 #
PB-290576/8 ..... N79-24515 #
PB-290577/6 ..... N79-24426 #
PB-290579/2 ..... N79-24537 #
PB-290583/4 ..... N79-24538 #
PB-290587/5 ..... N79-24891 #
PB-290589/1 ..... N79-24909 #
PB-290590/9 ..... N79-24910 #
PB-290594/1 ..... N79-24539 #
PB-290595/8 ..... N79-24427 #
PB-290598/2 ..... N79-24648 #
PB-290609/7 ..... N79-24110 #
PB-290612/1 ..... N79-24191 #
PB-290618/8 ..... N79-24545 #
PB-290653/5 ..... N79-24597 #
PB-290657/6 ..... N79-24579 #
PB-290675/8 ..... N79-24520 #
PB-290679/0 ..... N79-24284*#
PB-290690/7 ..... N79-24649 #
PB-290694/9 ..... N79-24621 #
PB-290716/0 ..... N79-24542 #
PB-290742/6 ..... N79-24911 #
PB-290748/3 ..... N79-24424 #
PB-290787/1 ..... N79-24249 #

PB-290808/5 ..... N79-24596 #
PB-290831/7 ..... N79-24327 #
PB-290833/3 ..... N79-24246 #
PB-290835/8 ..... N79-24519 #
PB-290854/9 ..... N79-24594 #
PB-290859/8 ..... N79-24533 #
PB-290872/1 ..... N79-24423 #
PB-290897/8 ..... N79-24540 #
PB-290909/1 ..... N79-24544 #
PB-290916/6 ..... N79-24541 #
PB-290930/7 ..... N79-24250 #
PB-290934/9 ..... N79-24518 #
PB-290940/6 ..... N79-24516 #
PB-290989/3 ..... N79-24428 #
PB-290992/7 ..... N79-24429 #
PB-290997/6 ..... N79-24903 #
PB-290998/4 ..... N79-24904 #
PB-291190/7 ..... N79-24405 #
PB-291335/8 ..... N79-24658*#
PB-291427/3 ..... N79-24199 #
PB-291437/2 ..... N79-24192 #
PB-291438/0 ..... N79-23944 #
PB-291508/0 ..... N79-24141 #
PB-291511/4 ..... N79-24142 #
PB-291539/5 ..... N79-24248 #
PB-291600/5 ..... N79-24251 #
PB-291622/9 ..... N79-24907 #
PB-291732/6 ..... N79-24247 #
PB-291733/4 ..... N79-24253 #
PB-291740/9 ..... N79-24914 #
PB-291790/4 ..... N79-24283 #
PB-291794/6 ..... N79-24517 #
PB-291823/3 ..... N79-24598 #
PB-291860/5 ..... N79-24526 #
PB-291861/3 ..... N79-24527 #
PB-291881/1 ..... N79-24908 #
PB-291900/9 ..... N79-24111 #
PB-291928/0 ..... N79-24530 #
PB-291938/9 ..... N79-24905 #
PB-291944/7 ..... N79-24595 #
PB-291946/2 ..... N79-24362 #
PB-291958/7 ..... N79-24522 #
PB-291966/0 ..... N79-24906 #
PB-291985/0 ..... N79-24676 #
PB-291986/8 ..... N79-24677 #
PB-292003/1 ..... N79-24912 #
PB-292008/0 ..... N79-24898 #
PB-292020/5 ..... N79-24200 #
PB-292697/0 ..... N79-24252 #
PB-292791/1 ..... N79-24913 #
PB-292963/6 ..... N79-24513 #

PDA-TR-1027-00-01 ..... N79-24058 #
PDA-TR-1065-00-19 ..... N79-23930 #
PDA-TR-1390-00-01 ..... N79-24377 #

PEL-REPORT-628 ..... N79-24566 #

PHYSICS-PUBL-79-183 ..... N79-24838 #

PL-79-022 ..... N79-24838 #

PM/78/1 ..... N79-24394 #
PM/78/4 ..... N79-24244 #
PM/78/5 ..... N79-24705 #
PM/78/6 ..... N79-24072 #
PM/78/7 ..... N79-24802 #
PM/78/8 ..... N79-24803 #

PNL-2868 ..... N79-24170 #
PNL-2871 ..... N79-24487 #

PPPL-1523 ..... N79-24765 #

PR-331 ..... N79-24565*#
PR-429 ..... N79-24696*#
PR-434 ..... N79-23995*
PR-437 ..... N79-23994*#

PREPRINT-79-158 ..... N79-24935*#

PSAD-79-16 ..... N79-23944 #

PSR-904 ..... N79-24230 #

PUBL-543 ..... N79-24309 #
PUBL-544 ..... N79-24310 #

PWRRC-TR-106 ..... N79-24538 #

P79-10062 ..... N79-23986*

QPR-1 ..... N79-24880 #
QPR-4 ..... N79-24450*#

QR-1 ..... N79-24454*#
QR-1 ..... N79-24455*#
QR-1 ..... N79-24456*#
QR-5 ..... N79-24470*#
QR-6 ..... N79-24448*#
QR-7 ..... N79-24184 #
QR-7 ..... N79-24186 #
QR-8 ..... N79-24457*#
QR-9 ..... N79-24458*#
QR-11 ..... N79-24453*#
QR-14 ..... N79-24472*#
QR-77-10052-4 ..... N79-24450*#

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R-1547 ..... N79-23973 #

RAD-78-100-170-03 ..... N79-24539 #

RADC-TR-78-235 ..... N79-24275 #
RADC-TR-78-272 ..... N79-24825 #
RADC-TR-78-275 ..... N79-24268 #
RADC-TR-78-280 ..... N79-24360 #

RC-100-195 ..... N79-24598 #

REPT-0-78 ..... N79-24109 #
REPT-1 ..... N79-24567*#
REPT-1 ..... N79-24877 #
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REPT-2-78 ..... N79-24608 #
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REPT-2-32000/8R-51672-VOL-2 ..... N79-23955 #
REPT-2-53500/8CRL-96 ..... N79-24155 #
REPT-7 ..... N79-24799 #
REPT-8-78 ..... N79-24779 #
REPT-10-78 ..... N79-23993 #
REPT-16 ..... N79-24796 #
REPT-77-2 ..... N79-24309 #
REPT-77-3 ..... N79-24310 #
REPT-77-213/R N79-24822
REPT-79TR30-PT-5 ..... N79-24373*#
REPT-2256/13 ..... N79-24473*#
REPT-9278-950001 ..... N79-24336 #

RI/RD79-165 ..... N79-24177 #

RPI-MATH-124 ..... N79-24776 #

RRL-PUBL-502 ..... N79-24671*#

RTS-11613 ..... N79-24342
RTS-11620 ..... N79-24343

R78AEGXIX ..... N79-23974 #
R79AEG388 ..... N79-23970*#

S-1480 ..... N79-24352*#

S/T-MEMO-1-77-VOL-1 ..... N79-24380 #

SAI-1-120-580-T6 ..... N79-23987*#
SAI-1-120-839-A5 ..... N79-24915*#
SAI-1-120-839-S4 ..... N79-24916*#
SAI-78-009-AA ..... N79-24584 #
SAI-79-782-WA ..... N79-24611 #

SAN-TR-79-2 ..... N79-24102 #

SANSO-TR-78-146 ..... N79-23998 #

SAN-1250-4 ..... N79-24880 #
SAN-1329-5 ..... N79-24423 #

SAND-78-0625 ..... N79-24512 #
SAND-78-2184 ..... N79-24511 #
SAND-78-7075 ..... N79-24071 #
SAND-78-8051 ..... N79-24510 #
SAND-79-0210C ..... N79-24878 #

SAO-SPECIAL-REPT-382 ..... N79-24821*#

SASR-17 ..... N79-24930*#

SC5128.2FR ..... N79-24126 #

SERI-35 ..... N79-24180 #

SIB-D-13-1978 ..... N79-24502 #

SIPL-78-1 ..... N79-24236 #

SOLAR/0012-78/29 ..... N79-24497 #
SOLAR/2002-78/50 ..... N79-24496 #
SOLAR/2002-78/60 ..... N79-24480 #
SOLAR/2003-78/50 ..... N79-24481 #
SOLAR/2003-78/60 ..... N79-24482 #
SOLAR/2005-78/50 ..... N79-24486 #
SOLAR/2005-78/60 ..... N79-24494 #
SOLAR/2008-78/50 ..... N79-24485 #
SOLAR/2008-78/60 ..... N79-24495 #
SOLAR/2011-78/50 ..... N79-24498 #
SOLAR/2011-78/60 ..... N79-24483 #
SOLAR/2015-78/50 ..... N79-24499 #
SOLAR/2015-78/60 ..... N79-24484 #

SONDERBEOB-36 ..... N79-24591 #

SORI-EAS-79-024 ..... N79-24540 #

SPRI-TR-78-1 ..... N79-24586 #

SR-21 ..... N79-24422 #
SR-517 ..... N79-24424 #

SRC-78-TR-29-PT-2 ..... N79-24355 #

SRD-78-041 ..... N79-24667 #
SRD-78-171 ..... N79-24919*#

SUGL-2922 ..... N79-24271 #

TAEB-79-1 ..... N79-24191 #
TAEB-79-4A ..... N79-24193 #

TASC-TR-1059-3 ..... N79-23958 #

TECH-REPT-79-096 ..... N79-24838 #

TI-03-79-10 ..... N79-24451*#
TI-03-79-17 ..... N79-24449*#

TID-28983 ..... N79-24626 #

TIR-741-MED-4011 ..... N79-24637*#
TIR-741-MED-4015 ..... N79-24638*#
TIR-741-MED-4016 ..... N79-24639*#
TIR-741-MED-4017 ..... N79-24640*#
TIR-741-MED-4021 ..... N79-24636*#
TIR-741-MED-4024 ..... N79-24635*#
TIR-741-MED-4025 ..... N79-24641*#
TIR-741-MED-5006 ..... N79-24644*#
TIR-741-MED-5012 ..... N79-24642*#

TN-1978-29 ..... N79-24238 #

TQR-10 ..... N79-24473*#

TR-2 ..... N79-24447*#
TR-6 ..... N79-24795 #
TR-7 ..... N79-24165 #
TR-8 ..... N79-24129 #
TR-18 ..... N79-24105 #
TR-21 ..... N79-24796 #
TR-22 ..... N79-24797 #
TR-23 ..... N79-24100 #
TR-34 ..... N79-23949 #
TR-45 ..... N79-23950 #
TR-46 ..... N79-24378 #
TR-79-01 ..... N79-24125 #
TR-532 ..... N79-24763 #
TR-0078(3506-01)-1 ..... N79-23989 #
TR-0079(4970-40)-1 ..... N79-24826 #

TST-27 ..... N79-24221 #

TT74-52006 ..... N79-23908*#

UCID-18084-PT-1 ..... N79-24877 #

UCRL-81575 ..... N79-24617 #
UCRL-82003 ..... N79-24503 #
UCRL-82269 ..... N79-24479 #

UIEM-79-2 ..... N79-24234 #
UIEM-79-3 ..... N79-24226 #

UILU-ENG-79-2501 ..... N79-24569*#
UILU-ENG-79-2502 ..... N79-24570*#
UILU-ENG-79-2503 ..... N79-24571*#
UILU-ENG-79-2541 ..... N79-24234 #
UILU-ENG-79-2542 ..... N79-24226 #

UNTA-MA-06-0049-78-6 ..... N79-24898 #

UNTA-ND-11-0003-79-1 ..... N79-24909 #
UNTA-ND-11-0003-79-2 ..... N79-24910 #

URS-7004-05-01 ..... N79-24522 #

US-PATENT-APPL-SN-32306 ..... N79-24260*#
US-PATENT-APPL-SN-023436 ..... N79-23971*#
US-PATENT-APPL-SN-027557 ..... N79-24061*#
US-PATENT-APPL-SN-037066 ..... N79-24153*#
US-PATENT-APPL-SN-037072 ..... N79-24197*#
US-PATENT-APPL-SN-041146 ..... N79-24154*#
US-PATENT-APPL-SN-598969 ..... N79-24432*
US-PATENT-APPL-SN-598969 ..... N79-24433*
US-PATENT-APPL-SN-712270 ..... N79-24646*#
US-PATENT-APPL-SN-753965 ..... N79-24651*
US-PATENT-APPL-SN-762362 ..... N79-24433*
US-PATENT-APPL-SN-762363 ..... N79-24432*
US-PATENT-APPL-SN-777983 ..... N79-24210*
US-PATENT-APPL-SN-833637 ..... N79-24257*
US-PATENT-APPL-SN-837259 ..... N79-24652*
US-PATENT-APPL-SN-848794 ..... N79-24431*
US-PATENT-APPL-SN-856460 ..... N79-24073*
US-PATENT-APPL-SN-876431 ..... N79-24254*
US-PATENT-APPL-SN-883094 ..... N79-24651*
US-PATENT-APPL-SN-893382 ..... N79-24285*
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US-PATENT-APPL-SN-900842 ..... N79-24203*
US-PATENT-APPL-SN-940688 ..... N79-24062*

US-PATENT-CLASS-2-2.1A N79-24651*
US-PATENT-CLASS-3-1.1 ..... N79-24652*
US-PATENT-CLASS-3-12.5 ..... N79-24652*
US-PATENT-CLASS-29-57-A N79-24431*
US-PATENT-CLASS-29-572 ..... N79-24431*
US-PATENT-CLASS-29-739 ..... N79-24431*
US-PATENT-CLASS-29-809 ..... N79-24431*
US-PATENT-CLASS-73-647 ..... N79-24203*
US-PATENT-CLASS-73-714 ..... N79-24285*
US-PATENT-CLASS-73-724 ..... N79-24203*
US-PATENT-CLASS-126-270 ..... N79-24432*
US-PATENT-CLASS-126-271 ..... N79-24433*
US-PATENT-CLASS-126-400 ..... N79-24433*
US-PATENT-CLASS-195-127 ..... N79-24073*
US-PATENT-CLASS-204-195B N79-24073*
US-PATENT-CLASS-210-108 ..... N79-24285*
US-PATENT-CLASS-210-142 ..... N79-24285*
US-PATENT-CLASS-228-5.1 ..... N79-24431*
US-PATENT-CLASS-228-6 ..... N79-24431*
US-PATENT-CLASS-237-1A N79-24433*
US-PATENT-CLASS-264-1 ..... N79-24432*
US-PATENT-CLASS-264-33 ..... N79-24432*
US-PATENT-CLASS-264-34 ..... N79-24432*
US-PATENT-CLASS-264-35 ..... N79-24432*
US-PATENT-CLASS-264-70 ..... N79-24432*
US-PATENT-CLASS-264-71 ..... N79-24432*
US-PATENT-CLASS-264-510 ..... N79-24432*
US-PATENT-CLASS-264-516 ..... N79-24432*
US-PATENT-CLASS-285-235 ..... N79-24651*
US-PATENT-CLASS-307-82 ..... N79-24254*
US-PATENT-CLASS-343-100TD N79-24210*
US-PATENT-CLASS-350-288 ..... N79-24433*
US-PATENT-CLASS-350-292 ..... N79-24432*
US-PATENT-CLASS-350-294 ..... N79-24432*
US-PATENT-CLASS-350-296 ..... N79-24432*
US-PATENT-CLASS-350-299 ..... N79-24433*
US-PATENT-CLASS-363-56 ..... N79-24254*
US-PATENT-CLASS-363-71 ..... N79-24254*
US-PATENT-CLASS-363-71 ..... N79-24257*
US-PATENT-CLASS-363-95 ..... N79-24257*
US-PATENT-CLASS-363-97 ..... N79-24254*
US-PATENT-CLASS-363-134 ..... N79-24257*
US-PATENT-CLASS-405-229 ..... N79-24432*

US-PATENT-CLASS-405-263 ..... N79-24432*
US-PATENT-CLASS-414-6 ..... N79-24652*
US-PATENT-CLASS-428-366 ..... N79-24062*

US-PATENT-4,065,053 ..... N79-24432*
US-PATENT-4,065,053 ..... N79-24433*
US-PATENT-4,091,464 ..... N79-24651*
US-PATENT-4,148,031 ..... N79-24210*
US-PATENT-4,148,962 ..... N79-24062*
US-PATENT-4,149,233 ..... N79-24257*
US-PATENT-4,149,278 ..... N79-24652*
US-PATENT-4,149,423 ..... N79-24203*
US-PATENT-4,149,521 ..... N79-24433*
US-PATENT-4,149,665 ..... N79-24431*
US-PATENT-4,149,817 ..... N79-24432*
US-PATENT-4,149,938 ..... N79-24073*
US-PATENT-4,150,425 ..... N79-24254*
US-PATENT-4,151,086 ..... N79-24285*
US-PATENT-4,151,612 ..... N79-24651*

USAAVRADCOM-76-0868-F ..... N79-24232 #

USARTL-TR-78-23B-VOL-2B ..... N79-23934 #
USARTL-TR-78-23C-VOL-3A ..... N79-23932 #
USARTL-TR-78-23C-VOL-3B ..... N79-23933 #
USARTL-TR-78-23F-VOL-6B ..... N79-23931 #
USARTL-TR-79-2 ..... N79-23975 #
USARTL-TR-79-3 ..... N79-23973 #

USCG-D-73-78 ..... N79-24104 #

USNA-EW-10-78 ..... N79-24101 #

UVA/528166/MAE79/101 ..... N79-24769*#

WERI-100 ..... N79-24426 #

W79-03034 ..... N79-24914 #
W79-03660 ..... N79-24538 #
W79-03662 ..... N79-24515 #
W79-03663 ..... N79-24426 #
W79-03666 ..... N79-24891 #
W79-03683 ..... N79-24536 #
W79-03688 ..... N79-24110 #
W79-03689 ..... N79-24427 #
W79-03762 ..... N79-24542 #
W79-04077 ..... N79-24428 #
W79-04078 ..... N79-24429 #
W79-04109 ..... N79-24903 #
W79-04110 ..... N79-24904 #

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